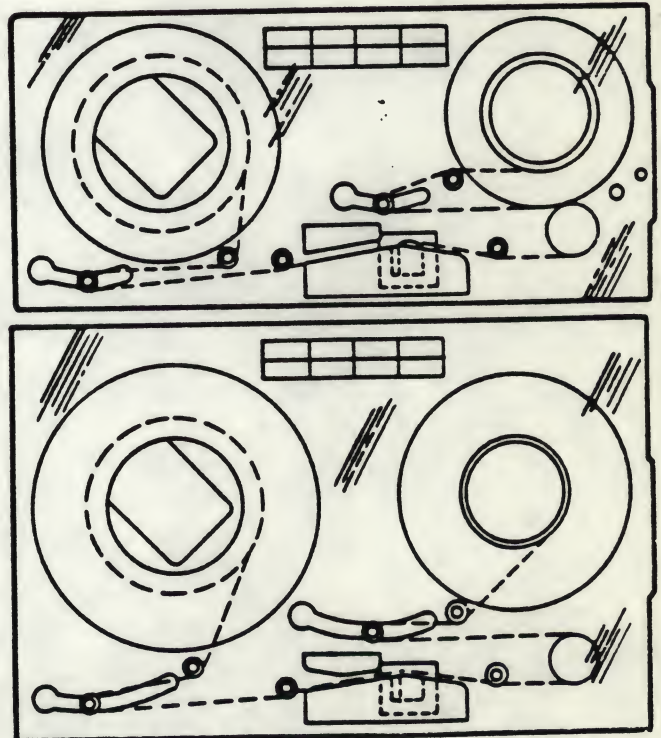
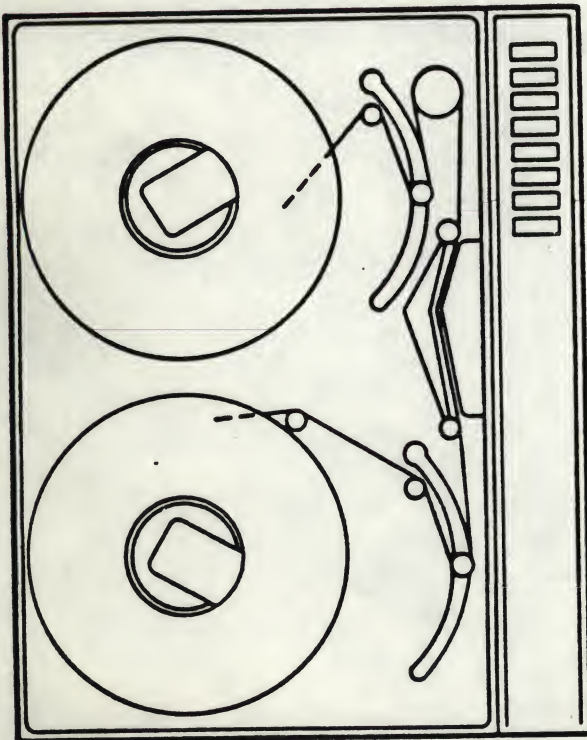


Cipher
Data Products

70-X 80-X 100-X PRODUCT DESCRIPTION



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TABLE OF CONTENTS

	Page
1.0 <u>INTRODUCTION</u>	1
1.1 PHYSICAL DESCRIPTION	3
1.2 TRANSPORT MECHANICS	3
1.3 FUNCTIONAL DESCRIPTION	4
2.0 <u>OPERATION</u>	8
2.1 LOADING TAPE	13
2.2 UNLOADING TAPE	15
3.0 <u>SPECIFICATIONS</u>	16
3.1 INTERFACE CONNECTIONS	16
3.2 MULTIPLE-TRANSPORT (DAISY-CHAIN) SYSTEM MODIFICATIONS	20
4.0 <u>BASIC CONCEPTS OF DIGITAL RECORDING</u>	34
4.1 NRZI SYSTEM	35
4.2 PHASE-ENCODE SYSTEM	36

THE UNIVERSITY OF CHICAGO

DEPARTMENT OF CHEMISTRY

PHYSICAL CHEMISTRY

LECTURE NOTES

1954-55

BY

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LIST OF FIGURES

Figure		Page
1-1	SYSTEM BLOCK DIAGRAM	5
2-1	WRITE DATA BLOCK DIAGRAM	9
2-2	READ DATA BLOCK DIAGRAM	10
2-3	MODEL 100X TAPE PATH AND RELATED PARTS	13
2-4	TAPE PATH AND RELATED PARTS	14
3-1	INTERFACE CONFIGURATION	16
3-2	OUTLINE DIMENSIONS, MODEL 70X	22
3-3	OUTLINE DIMENSIONS, MODEL 80X	23
3-4	OUTLINE DIMENSIONS, MODEL 100X	24
3-5	RACK MOUNTING AND DIMENSIONS (100X)	25
4-1	MAGNETIC RECORDING WAVEFORMS	34
4-2	NRZI NINE-TRACK DATA FORMAT	35
4-3	PHASE-ENCODED TAPE MAGNETIZATION	37
4-4	PHASE-ENCODED TAPE BLOCK FORMAT	39

LIST OF TABLES

Table		Page
1-1	COMMON SPARES	2
2-1	CONTROLS AND INDICATORS	11
3-1	MECHANICAL AND ELECTRICAL SPECIFICATIONS	17
3-2	INTERFACE CONNECTIONS	26
3-3	INTERFACE INPUTS	29
3-4	INTERFACE OUTPUTS	31
3-5	CONTROL LOGIC OPTIONS	32
3-6	DATA LOGIC OPTIONS	33

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INTRODUCTION

Models 70X, 80X, and 100X Magnetic Tape Transports are high performance, digital, tape transports manufactured by Cipher Data Products, Inc., San Diego, California. The transports are available with a dual-gap head, providing read-after-write capability, or a single-gap head for applications where simultaneous read and write operations are not required. The Model 100X transport is designed to operate on 105- to 250-Vac, single-phase, 48- to 63-Hz line power. If the compliance arm retraction feature is not required, the transport can operate on line power frequencies up to 450 Hz. Reels to 10.5 inches (2400') in diameter can be accommodated. Models 70X and 80X are designed to operate on 117- to 230-Vac, single-phase, 48- to 400-Hz line power. The Model 70X transport accommodates a 7-inch (600') reel, while the Model 80X takes an 8-1/2-inch (1200') reel. Various tape-speed and density capabilities and other options are available, as follows:

a. Operation in the following modes:

- (1) Seven- or nine-track
- (2) Read-after-write
- (3) Read/write
- (4) Write only
- (5) Read only

b. Overwrite

c. Tape Speeds

- (1) 100X: 45, 37.5, 25, 18.75, or 12.5 ips
- (2) 80X: 37.5, 25, 18.75, or 12.5 ips
- (3) 70X: 25, 18.75, or 12.5 ips
- (4) Nonstandard: Any fixed speed within the ranges specified above.

d. Data densities: 800, 556, 200 bpi (NRZI); 1600 bpi (PE)

e. Dual-density combinations: 1600/800, 800/556, 800/200, 556/200 bpi

f. Local density selection

TABLE 1-1. COMMON SPARES

SUB-ASSEMBLIES	70X	80X	100X
Data Boards			
Phase Encode	X	X	X
NRZI	X	X	X
Dual Mode	X	X	X
EOT/BOT Assembly	X	X	X
Reel Hub Assembly	X	X	X
File Protect Switch Assembly	X	X	X
Magnetic Tape Head Assembly	X	X	X
Capstan Motor Assembly	X	X	
Transformer Assembly	X	X	
Reel Motor Assembly	X	X	
Control Switch Housing Assembly	X	X	
Hinged Standoff Assembly	X	X	
Servo PWB Assembly	X	X	
Power/Control PWB Assembly	X	X	

Inventory of the [illegible] Collection

No.	Date	Description	Remarks
1	1890	[illegible]	[illegible]
2	1891	[illegible]	[illegible]
3	1892	[illegible]	[illegible]
4	1893	[illegible]	[illegible]
5	1894	[illegible]	[illegible]
6	1895	[illegible]	[illegible]
7	1896	[illegible]	[illegible]
8	1897	[illegible]	[illegible]
9	1898	[illegible]	[illegible]
10	1899	[illegible]	[illegible]
11	1900	[illegible]	[illegible]
12	1901	[illegible]	[illegible]
13	1902	[illegible]	[illegible]
14	1903	[illegible]	[illegible]
15	1904	[illegible]	[illegible]
16	1905	[illegible]	[illegible]

- g. Remote density selection
- h. Power: 400-Hz operation (without compliance arm retraction system)
- i. Logic options
- j. Embedded formatter (optional) NRZl, PE, or PE/NRZl
- k. Dual-Mode: NRZI/PE with data densities of 800/1600 respectively.

The transports are designed to be used in data acquisition and computer processing systems in which data must be acquired and stored on magnetic tape. Writing and reading of digital data are performed in IBM-compatible, NRZI or PE format. Data recorded by 70X, 80X, and 100X transports is completely recoverable by IBM or similar equipment.

1.1

PHYSICAL DESCRIPTION

The Model 100X transport is designed to be hinge-mounted in a standard 19-inch equipment rack. The Model 70X and 80X transports are designed to be slide-mounted in a standard, 19 inch, equipment rack. All components are mounted on a precision-ground, cast-aluminum plate. When the equipment rack is securely anchored, the printed circuit boards and other internal components can be made accessible from the front by releasing the adjustable pawl fastener and either sliding the transport open or in the case of the Model 100X swinging the transport open on its hinges.

Four printed wiring boards are used in the 70X and 80X read-after-write models: a read/write board, a control/power board, and a servo board, all mounted behind the mounting plate. The Model 100X transport consists of four printed wiring boards: a read/write board, a control/servo board, and a power board, all mounted on the rear of the mounting plate.

A transparent, hinged, front cover protects the transport from dust and other foreign matter while allowing observation of tape motion. The pushbutton controls, which illuminate when the commanded sequence is complete, are mounted on the front trim panel, where they are accessible with the cover closed. The power connector is a standard, three-pin, grounded plug.

1.2

TRANSPORT MECHANICS

The reel to reel transport uses two servo-controlled, direct-drive, dc torque motors to drive the tape reels. The reels

REPORT

ON THE

PROGRESS OF THE

WORK DURING THE

PAST YEAR

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PLANS FOR THE

FUTURE

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FOR THE

YEAR 1900

are secured to their hubs by lever-actuated expanding rings which give a full 360 degree contact surface with the inner hub of the tape reel. On Models 70X and 80X a fixed, flanged hub is used for tape take-up instead of a take-up reel. Two spring-loaded compliance arms maintain tape tension and serve as tape-storage buffers. Model 100X has a compliance arm retractor system, energized when power is turned on, drives the compliance arms to their full-up positions for ease of tape threading. During the load sequence the compliance arms are returned to their operating positions to perform buffering and tensioning functions.

The tape path includes both roller and fixed guides, the head, cross-feed shield, and tape cleaner. The roller guides utilize precision bearings to minimize friction and reduce wear, and the wearing surfaces of the fixed guides are hard-chrome plated. The fixed guides, on each side of the head, are of the single-edge type. The outer (reference) flange of each guide is fixed to an exact dimension, and the bottom flange is spring loaded to guide the tape against the reference edge at all times. This arrangement provides minimum skew and minimizes the effect of tape width variations. In addition, the head and cross-feed shield are mounted on an adjustable plate which provides for precise azimuth alignment.

On the Model 100X a tape cleaner is mounted between the supply reel and the lower compliance arm roller guide to minimize tape contamination. On Models 70X and 80X the tape cleaner is mounted on the supply reel side of the head.

1.3

FUNCTIONAL DESCRIPTION

Figure 1-1 is a system block diagram. The 70X, 80X, and 100X transports use a 180-degree-wrap capstan drive for controlling tape movement during write, read, and rewind operations. The capstan is controlled by a velocity servo. The velocity information is generated by a dc tachometer that is directly coupled to the capstan motor shaft and produces a voltage proportional to the angular velocity of the capstan. This voltage is compared to the reference voltage from the ramp generator by means of operational amplifier techniques, and the difference is used to control the capstan motor. This capstan control technique gives precise control of tape accelerations and tape velocities, thus minimizing tape tension transients.

During a write operation, the tape is accelerated in a controlled manner to the required velocity. This velocity is

The first part of the report is a general description of the project. It includes the objectives, the scope of the work, and the organization of the project. The second part is a detailed description of the work done during the project. It includes the methods used, the results obtained, and the conclusions drawn. The third part is a summary of the project and a list of references.

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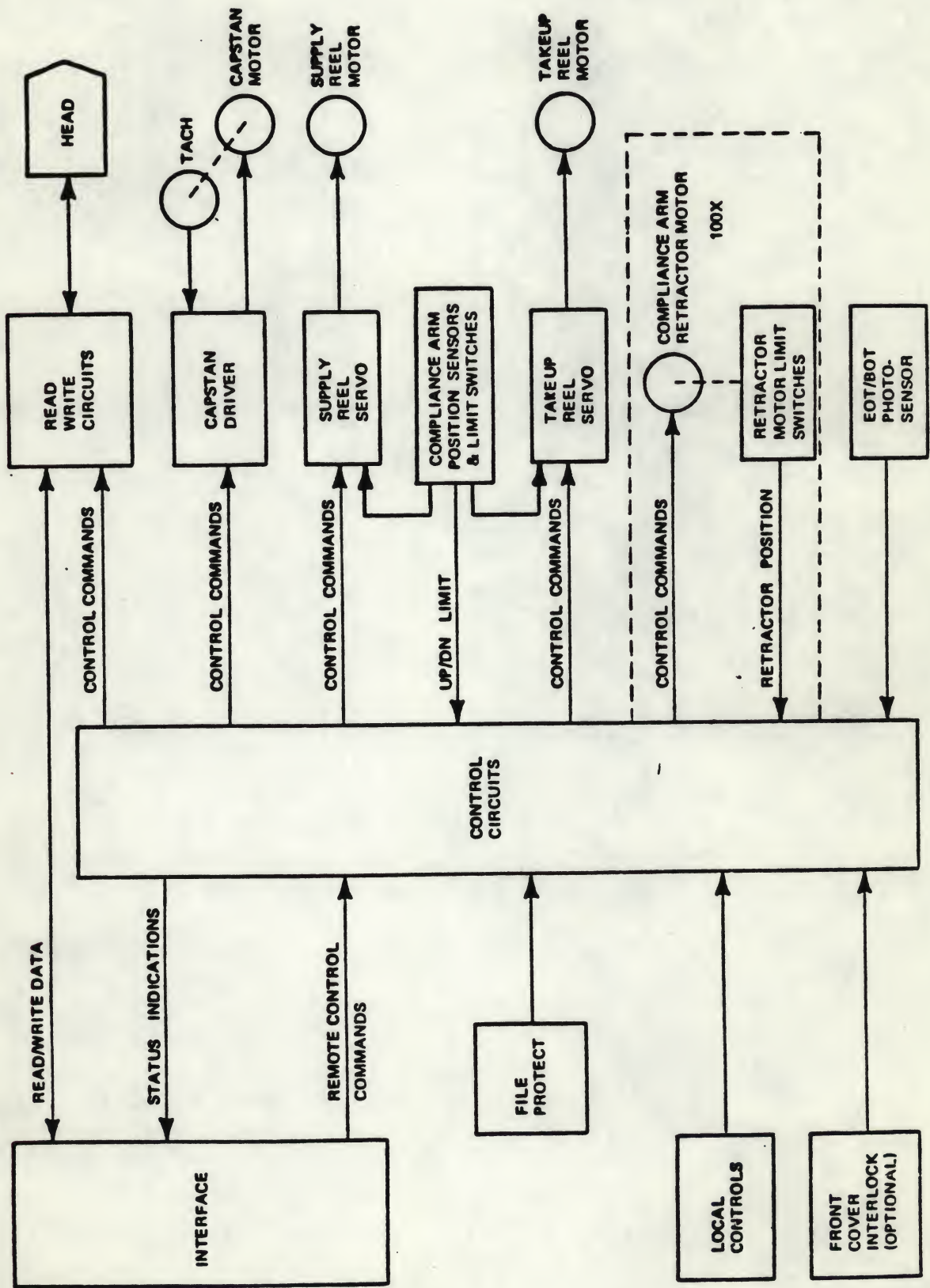


FIGURE 1-1 SYSTEM BLOCK DIAGRAM



maintained constant, and data characters are written on the tape at a constant rate. Thus, the following relationship exists:

$$\text{Bit density} = \frac{\text{Character Rate}}{\text{Tape Velocity}}$$

When data recording is complete, the tape is decelerated to zero velocity in a controlled manner. Since the write operation relies on a constant tape velocity, inter-record gaps (IRG) must be provided to allow for the tape acceleration and deceleration periods. Control of tape motion to produce a defined IRG is provided externally by the customer controller, in conjunction with the tape acceleration and deceleration characteristics defined by the recorder specifications.

An optional overwrite feature provides for editing of previously recorded data. The Overwrite signal causes Write Enable to ramp on and off, minimizing the change in inter-record gap magnetism in rewriting a record. Write Reset, used with the over-write option, causes both write head current and erase head current to be turned off immediately after writing of the new record to prevent destruction of data in the following record.

During a read operation, the tape is accelerated to the required velocity in a time interval sufficiently short to allow tape velocity to become constant before data signals are received. Seven or nine data channels are presented to the interface, depending on the recorder model. They are accompanied by a Read Data Strobe pulse derived from a monostable multivibrator circuit (NRZI). The end of a record is detected in the customer controller by means of gap-detection circuits, and the tape is commanded to decelerate in a controlled manner. The transport can operate in the read mode in either the forward or reverse direction. When operating in a shuttling mode (e.g., synchronous forward, stop, synchronous reverse, and stop) no turnaround delay is required between the end of one motion command and the beginning of the next motion command in the opposite direction. To guarantee IBM-compatible tapes, with fully saturated gaps and precise dimensions, tape motion must be allowed to cease before switching of the motion control lines and Write Enable line.

In addition to the capstan control system, the transport incorporates supply and takeup reel servo systems, a compliance arm system, a magnetic head and associated read/write electronics, and the control logic.

THE UNIVERSITY OF CHICAGO
DIVISION OF THE PHYSICAL SCIENCES
DEPARTMENT OF CHEMISTRY

REPORT OF THE
COMMISSIONER OF THE GENERAL LAND OFFICE

IN RESPONSE TO A RESOLUTION OF THE BOARD OF LAND COMMISSIONERS
PASSED AT A MEETING OF THE BOARD HELD AT WASHINGTON, D. C.,
ON THE 10TH DAY OF JANUARY, 1906.

PRESENTED TO THE BOARD OF LAND COMMISSIONERS
AT A MEETING HELD AT WASHINGTON, D. C., ON THE 10TH DAY OF JANUARY, 1906.

BY
J. M. WILSON,
COMMISSIONER OF THE GENERAL LAND OFFICE.

WASHINGTON:
GOVERNMENT PRINTING OFFICE:
1906.

THE UNIVERSITY OF CHICAGO
DIVISION OF THE PHYSICAL SCIENCES
DEPARTMENT OF CHEMISTRY

The compliance arms compensate for differences in tape speed arising out of the relatively fast starts and stops of the capstan and those of the slower, high-inertia supply and takeup reels. When the rate of tape travel at the capstan differs from that at which the reels are supplying or taking up the tape, the supply and/or takeup reel compliance arms move to compensate for this difference. At the same time, a photoelectric sensor measures the resulting displacement of each arm and feeds an error signal to the respective reel motor servo. This signal is amplified and is used to control the reel motor, increasing or decreasing its speed as necessary to compensate for the momentary difference in tape speed and bring the compliance arm back to its nominal operating position. The compliance arm system is designed to provide a constant tape tension of 8 ounces, as long as the arms are within their operating regions. Tape spillage is prevented, in the event power is lost, by a self-braking feature designed into the servo circuitry. When power is lost the takeup reel motor terminals are connected together through a current-limiting resistor, and the supply reel motor terminals are directly connected, producing a dynamic braking action.

The magnetic head, under control of the read/write electronics, writes and reads the flux transitions on the tape. On the read-after-write recorder, the read function is operating continuously, while the write function must be enabled in order to operate. On the recorder with the single-gap head, the read and write functions are controlled by remote command. An erase head provides continuous dc erasure across the full width of the tape during write operations.

The control logic operates on manual commands to enable tape, once loaded, to be brought to the load point. At this stage remote commands control tape motion, writing, and reading. The logic also provides rewind and unload functions in conjunction with the manual REWIND control. A photoelectric sensor assembly, consisting of a lamp and two phototransistors, is used to detect the beginning-of-tape (BOT) and end-of-tape (EOT) markers as well as unthreaded or broken tape. The detection area of the sensor assembly is approximately 1.2 inches from the write head gap.

The read/write electronics, that can be used by the tape transports mentioned have been engineered with simplicity and modern day technology in mind. The data board is capable of operating at speeds in a range of 12.5 ips thru 125 ips. Speed change kits consist of components that insert into sockets. Also, the data electronics can be operated in a NRZI/PE mode of digital recording. With the Cipher dual-mode data PWB, it is possible to write all 1's

The first part of the report deals with the general situation of the country and the progress of the work. It is followed by a detailed account of the various projects and the results achieved. The report concludes with a summary of the work done and the plans for the future.

The second part of the report deals with the financial aspects of the work. It gives a detailed account of the income and expenditure of the organization and shows how the funds have been used. It also includes a statement of the assets and liabilities of the organization.

The third part of the report deals with the personnel of the organization. It gives a list of the staff and their duties and shows how the work has been organized. It also includes a statement of the salaries and other expenses of the staff.

The fourth part of the report deals with the results of the work. It gives a summary of the achievements of the organization and shows how the work has contributed to the development of the country. It also includes a statement of the recommendations for the future.

on a tape without the use of external test equipment. There is a visual indication of out-of-tolerance read skew, and a variety of DIP switch settings are available to aid the technician in troubleshooting. With improved design, the alignment potentiometers have been reduced in quantity from twenty-seven to nine. The nine adjustable potentiometers are used to adjust the NRZI/PE read recovery circuit gains. NRZI write deskew adjustments were difficult, time consuming, and error prone alignments on the data board. They are, for the first time, ended. The nine adjustable NRZI write deskew monostable multivibrators have been replaced with a 8X32 PROM; which is preprogramed to compensate for the write head gap scatter. To improve reliability, the overall parts count was cut 40%, which decreased the power consumption by one-half. (These numbers are in comparison with the older design.) Initial read head amplifiers are specially designed for high common mode rejection and no crossover distortion. This gives consistent and improved flux reversal resolution, so important in the phase encode mode. Hysteresis TTL receivers for all channel inputs to the write logic give protection from externally generated transients. Time domain filtering on the write reset and write strobe gives additional immunity on these strategic lines. Linear phase response active filters provide unwanted signal attenuation with impact on the desired signals. A special dual-operation threshold circuitry reduces IRG drop-in type noise while allowing a lower read threshold for increased data recovery. This allows accurate rendition of the postamble to IRG transition. Also, threshold circuitry has been revised to eliminate bit shift arising from envelope variations. Write circuitry rise and fall times have been decreased for improved resolution in Phase-encode operation. Use of crosshatch power and ground distribution has increased the signal to noise ratio. At frequencies under 200 MHz, the board acts like a ground plane, giving low noise generation and pickup. All the features taken into account means improved data reliability in the host system. Figures 2-1 and 2-2 illustrate block diagrams of the write data and read data circuitry.

2.0

OPERATION

Control/indicator types, functions, and the conditions required for enabling the corresponding functions are given in Table 2-1.

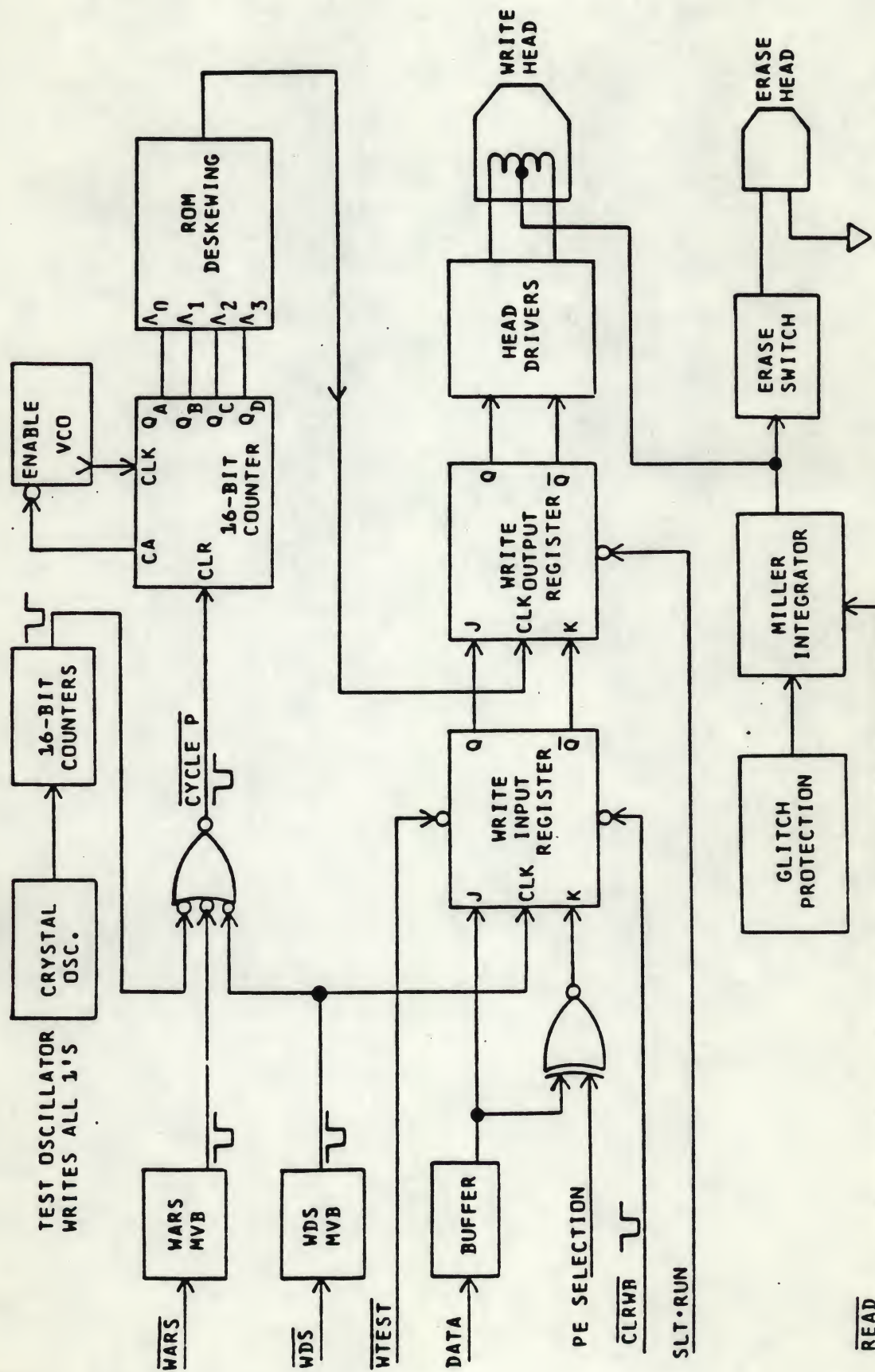
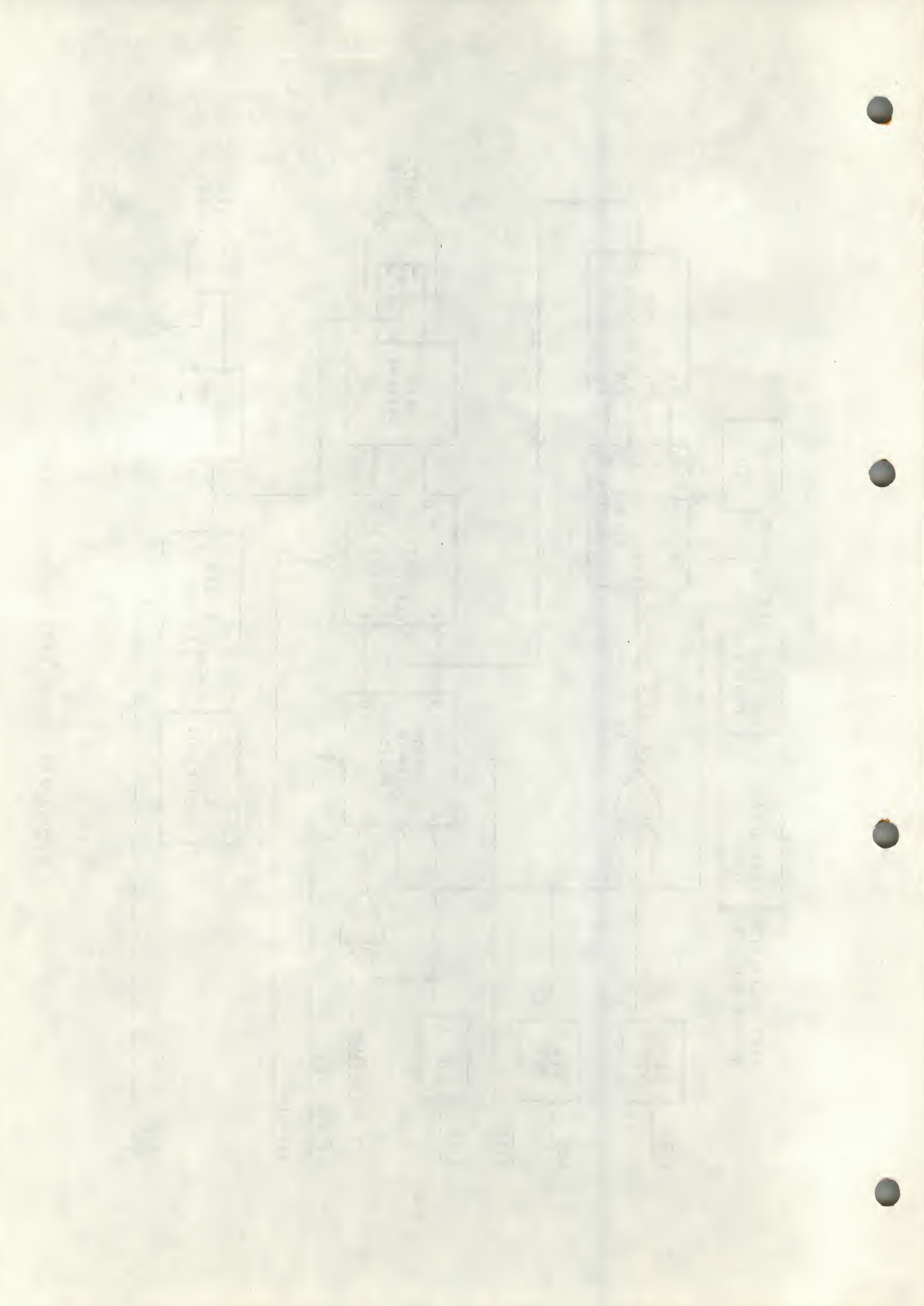


FIGURE 2-1 WRITE DATA BLOCK DIAGRAM



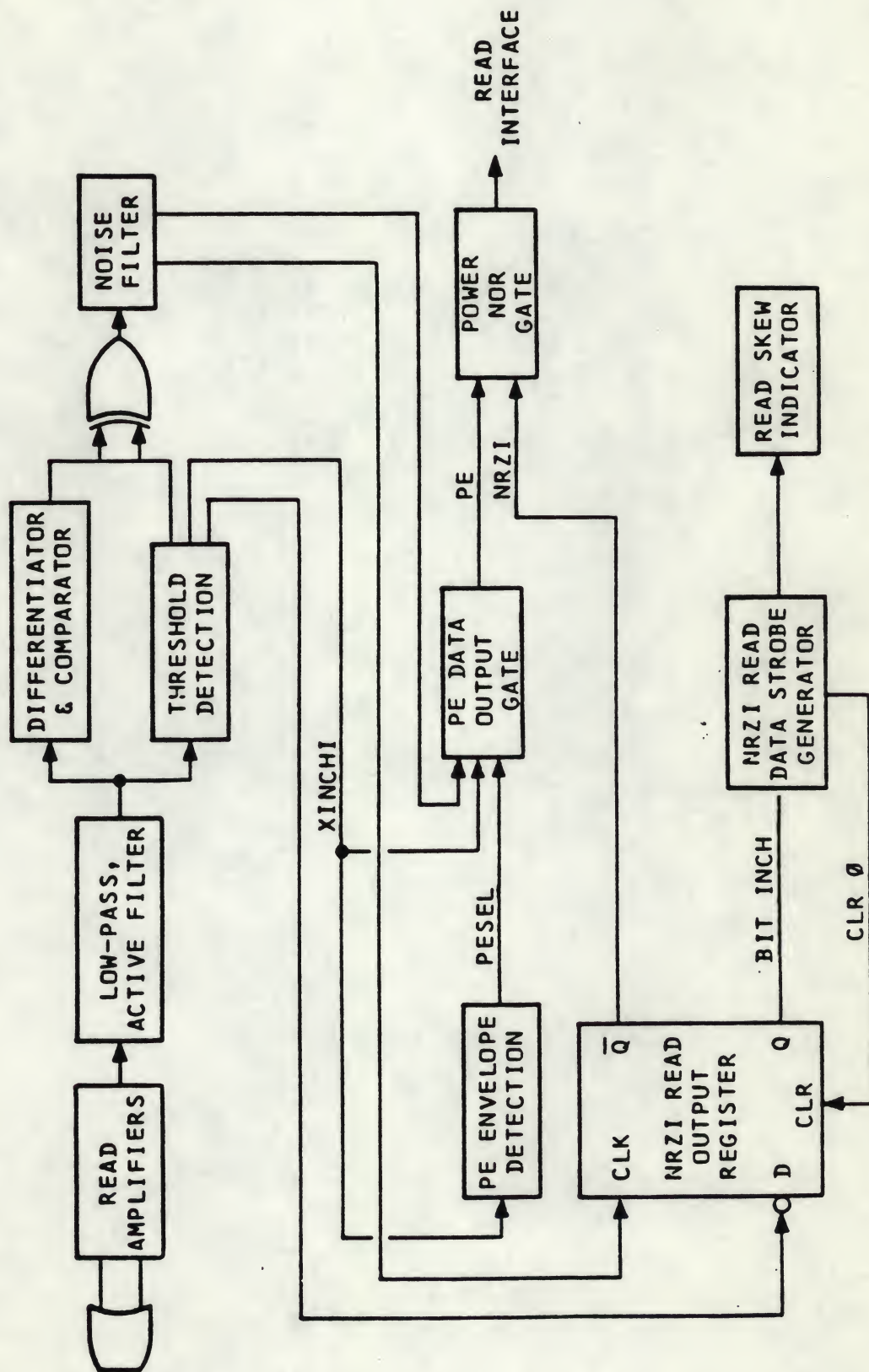


FIGURE 2-2 READ DATA BLOCK DIAGRAM

TABLE 2-1. CONTROLS AND INDICATORS

CONTROL OR INDICATOR	TYPE	FUNCTION	CONDITIONS
POWER	Alternate-Action Pushbutton/Indicator	Switches line Power on and off. Illuminates red to indicate power is on.	Fuse installed. Line cord connected.
LOAD	Momentary-Action Pushbutton/Indicator	Initial actuation energizes motors and servo system and tensions tape.	Power restored after being off. Loss of tape tension.
		Second actuation advances tape to load point.	Motors and servo system energized. Tape tensioned by initial actuation.
		Illuminates to indicate BOT tab is positioned at photo-sensor.	
ON LINE	Momentary-Action Pushbutton/Indicator	Switches recorder to on-line mode. Illuminates to indicate recorder is on line.	Initial Load or Rewind actuation. Recorder in off-line mode. (ON-LINE indicator extinguished.)
		Second actuation switches recorder off line. Indicator extinguished to indicate recorder is off line.	Recorder in on-line mode. (ON-LINE indicator illuminated.)
REWIND	Momentary-Action Pushbutton/Indicator	Rewinds tape to load point. REWIND indicator illuminates during rewinding then goes out.	Recorder in off-line mode. (ON LINE indicator not illuminated.)

Date	Location	Remarks	Remarks
1917 Nov 17	St. John's, Nfld.	Arrived at 10:30 AM. Weather clear.	
1917 Nov 18	St. John's, Nfld.	Left at 9:00 AM. Weather clear.	
1917 Nov 19	St. John's, Nfld.	Arrived at 10:30 AM. Weather clear.	
1917 Nov 20	St. John's, Nfld.	Left at 9:00 AM. Weather clear.	
1917 Nov 21	St. John's, Nfld.	Arrived at 10:30 AM. Weather clear.	
1917 Nov 22	St. John's, Nfld.	Left at 9:00 AM. Weather clear.	
1917 Nov 23	St. John's, Nfld.	Arrived at 10:30 AM. Weather clear.	
1917 Nov 24	St. John's, Nfld.	Left at 9:00 AM. Weather clear.	
1917 Nov 25	St. John's, Nfld.	Arrived at 10:30 AM. Weather clear.	
1917 Nov 26	St. John's, Nfld.	Left at 9:00 AM. Weather clear.	
1917 Nov 27	St. John's, Nfld.	Arrived at 10:30 AM. Weather clear.	
1917 Nov 28	St. John's, Nfld.	Left at 9:00 AM. Weather clear.	
1917 Nov 29	St. John's, Nfld.	Arrived at 10:30 AM. Weather clear.	
1917 Nov 30	St. John's, Nfld.	Left at 9:00 AM. Weather clear.	
1917 Dec 1	St. John's, Nfld.	Arrived at 10:30 AM. Weather clear.	
1917 Dec 2	St. John's, Nfld.	Left at 9:00 AM. Weather clear.	

TABLE 2-1. CONTROLS AND INDICATORS (Continued)

CONTROL OR INDICATOR	TYPE	FUNCTION	CONDITIONS
REWIND (Continued)		LOAD indicator illuminates to indicate BOT tab is positioned at photo-sensor.	
		Second actuation of REWIND push-button unloads tape.	
WRT EN (Write Enable)	Indicator	Illuminates to indicate write function may be performed.	Tape reel with write enable ring installed mounted on supply hub.
HI DEN (High Density)	Alternate-Action Pushbutton/Indicator	Selects read density. Illuminates to indicate high-density mode is selected.	
FORWARD	Alternate-Action Pushbutton/Indicator	Starts/stops tape forward motion. Illuminates to indicate recorder in forward mode.	Recorder in off-line mode (ON LINE indicator extinguished).
REVERSE	Alternate-Action Pushbutton/Indicator	Starts/stops tape reverse motion. Illuminates to indicate recorder in reverse mode.	Recorder in off-line mode (ON LINE indicator extinguished).

2.1

LOADING TAPE

To load tape, see Figure 2-3 or 2-4 and proceed as follows:

- a. Pull out reel-locking level on supply hub. Ensure that tape reel has write enable ring installed if Write mode is to be utilized. Place reel of tape on hub so that tape will unwind when reel is rotated in clockwise direction. Press reel evenly and firmly against hub's back flange and push in locking lever. Spin reel counterclockwise while looking along its rim to ensure even mounting.

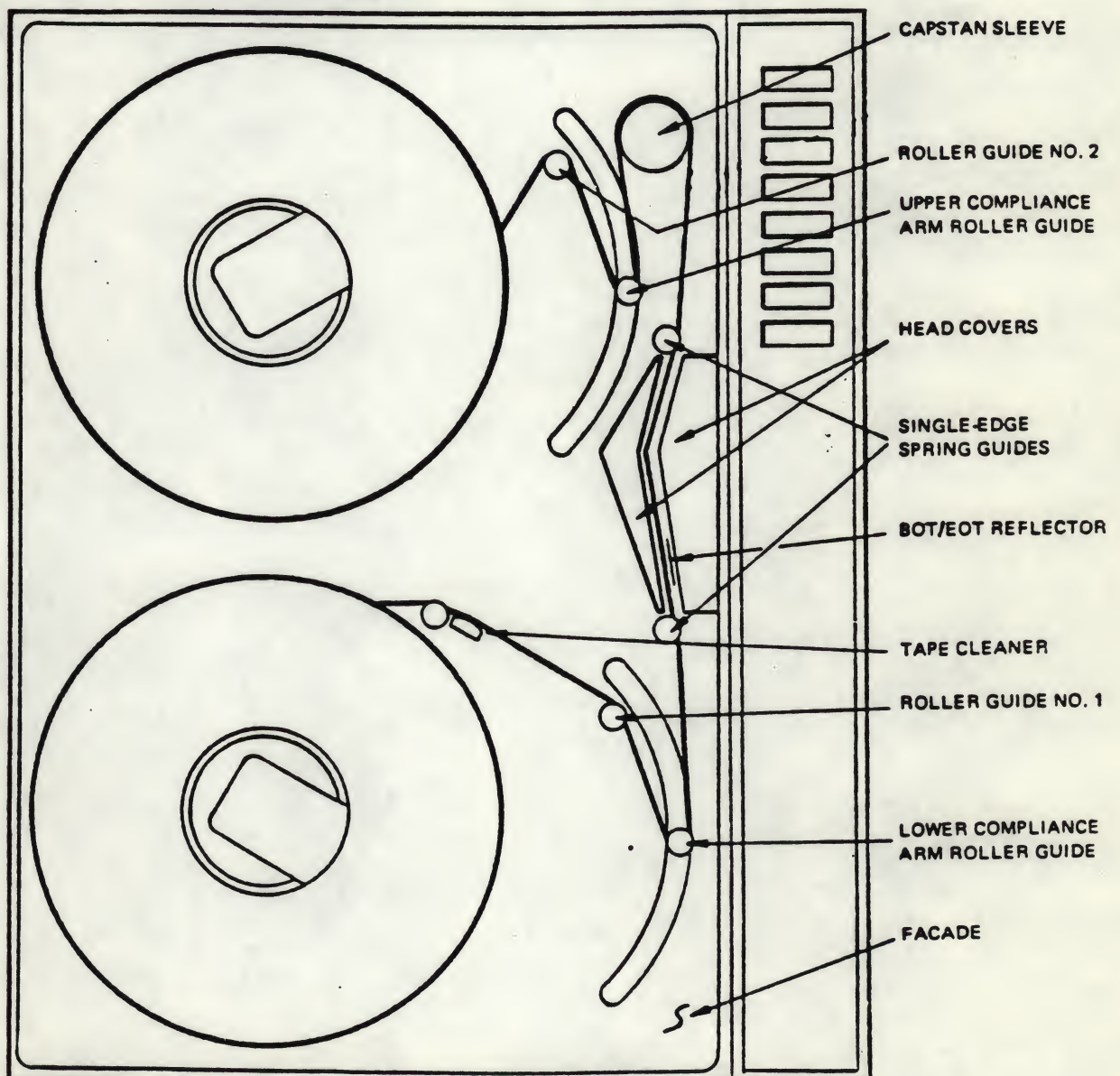


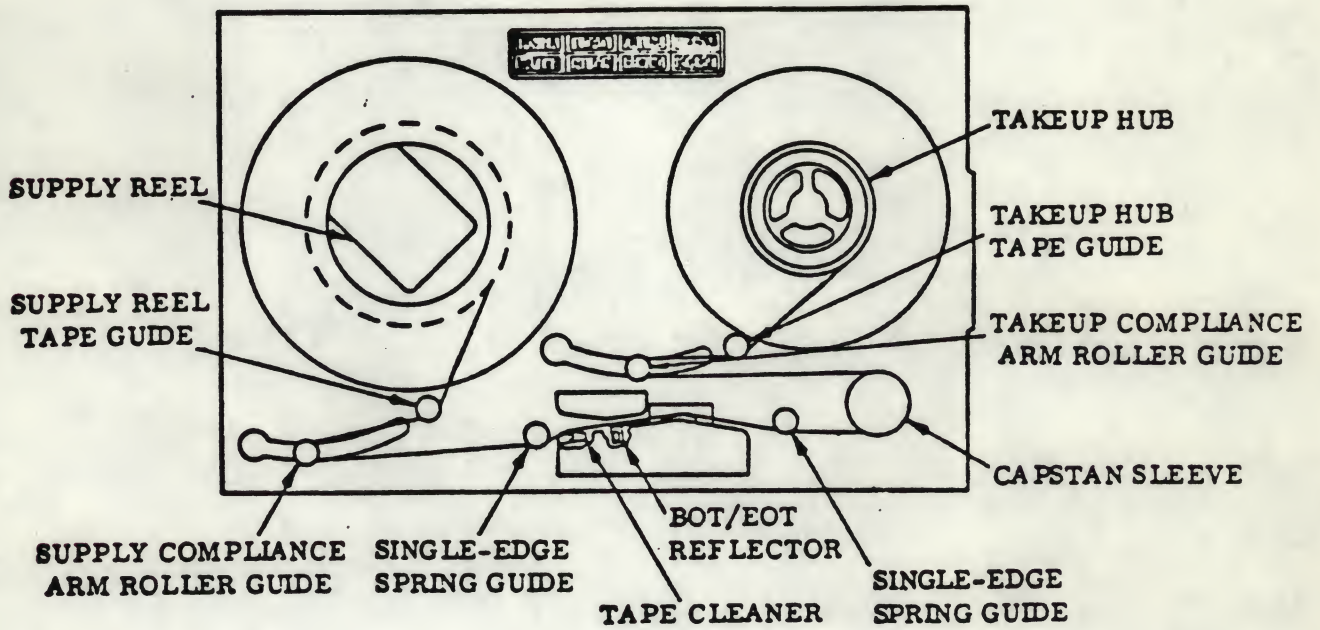
FIGURE 2-3 MODEL 100X TAPE PATH AND RELATED PARTS

1. The first part of the paper is devoted to a discussion of the general principles of the theory of the structure of the atom. It is shown that the structure of the atom is determined by the laws of quantum mechanics, and that the structure of the atom is determined by the laws of quantum mechanics.



2. The second part of the paper is devoted to a discussion of the general principles of the theory of the structure of the atom. It is shown that the structure of the atom is determined by the laws of quantum mechanics, and that the structure of the atom is determined by the laws of quantum mechanics.

MODEL 80X



MODEL 70X

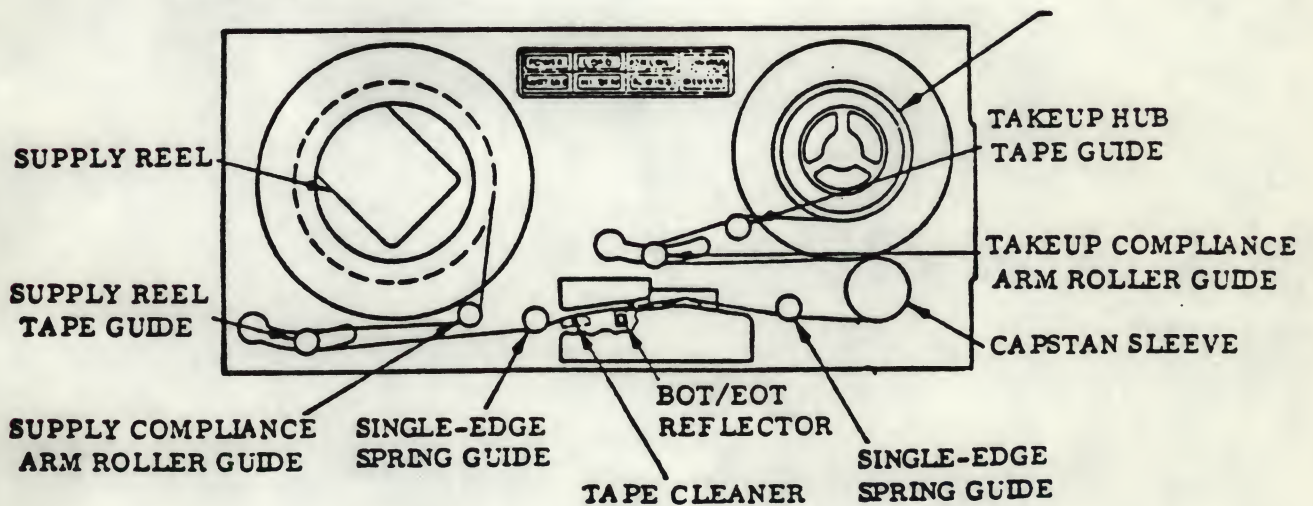


FIGURE 2-4 TAPE PATH AND RELATED PARTS



- b. Install empty reel on takeup hub in same manner as loaded reel was mounted in step a.
- c. Actuate POWER pushbutton. POWER indicator will illuminate.
- d. Thread tape along path shown in Figure 2-4. Wrap several turns clockwise around takeup reel. Check that tape is correctly seated on guides and properly threaded through photosensor and head assembly.
- e. Close front cover to protect tape and transport from dust.
- f. Actuate LOAD pushbutton and observe that tape is tensioned. Actuate LOAD pushbutton again. Tape will advance until BOT tab is positioned at photosensor. LOAD indicator will illuminate, indicating recorder is ready for use.

2.2

UNLOADING TAPE

To unload the tape, proceed as follows:

NOTE

Transport must be in off-line mode (ON LINE indicator extinguished).

- a. If power is off, actuate POWER pushbutton and proceed to step b. If power is on, start with step c.
- b. Actuate LOAD pushbutton to tension tape.
- c. Actuate REWIND pushbutton. REWIND indicator will illuminate. If tape is at load point tape will rewind until tension is lost. If tape is not at load point, rewind ceases when BOT tab is reached. BOT tab is then positioned automatically at photosensor, and LOAD indicator illuminates. Actuate REWIND pushbutton second time to complete unload sequence
- Manual REWIND command will override load sequence. This can be used to return tape to load point in event load sequence is inadvertently initiated after BOT tab has passed photosensor.

1. The first part of the report is a general introduction to the subject of the study.

2. The second part of the report is a detailed description of the methods used in the study.

3. The third part of the report is a discussion of the results of the study and their implications.

4. The fourth part of the report is a conclusion and a list of references.

5. The fifth part of the report is an appendix containing additional data and figures.

6. The sixth part of the report is a bibliography of the literature cited in the study.

APPENDIX A: DATA AND FIGURES

Table 1

Table 2

Table 3

Table 4

Table 5

Table 6

Table 7

Table 8

Table 9

3.0

SPECIFICATIONS

Mechanical and electrical specifications are given in Table 3-1. Signal characteristics are as follows:

a. Levels

- (1) True is low: 0 to 0.4 volt (approximately)
- (2) False is high: +3 volts (approximately)

b. Pulses

- (1) Levels as above.
- (2) Edge transmission delay over 20 feet of cable is not greater than 200 nanoseconds.

The interface circuits are so designed that a disconnected wire results in a false signal. Figure 3-1 shows the interface configuration for which the recorder is designed.

3.1

INTERFACE CONNECTIONS

Interconnection of Cipher Data Products and customer equipment requires a harness of individual twisted pairs, each with the following characteristics:

- a. Maximum length of 20 feet
- b. Not less than one twist per inch.

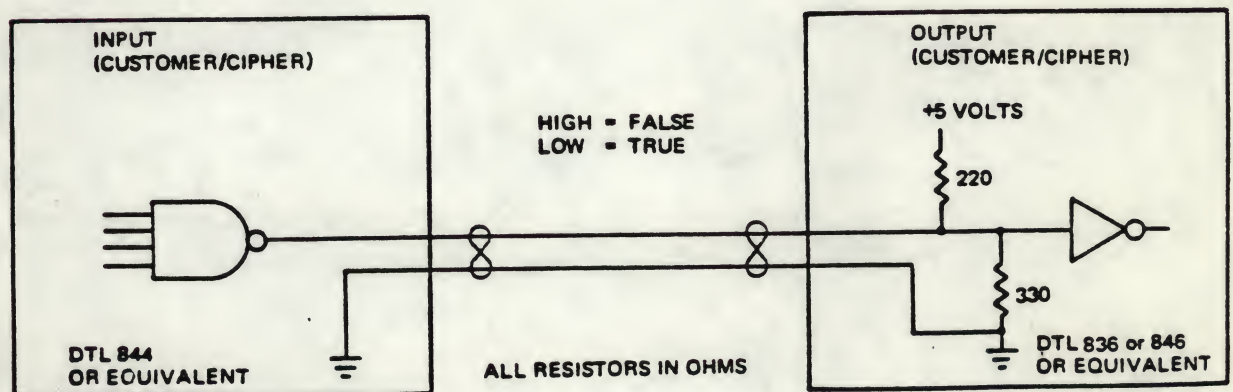


FIGURE 3-1 INTERFACE CONFIGURATION

THE UNIVERSITY OF CHICAGO
DEPARTMENT OF CHEMISTRY
CHICAGO, ILLINOIS 60637

MEMORANDUM FOR THE RECORD
DATE: 10/1/68

TO: DR. J. H. GOLDSTEIN
FROM: DR. J. H. GOLDSTEIN
SUBJECT: 1,2-DICHLOROETHANE
1. The following data were obtained from the study of the
1,2-dichloroethane system. The data are presented in the
table below. The data are for the system at 25°C.
2. The data are for the system at 25°C.
3. The data are for the system at 25°C.



Figure 1. Schematic diagram of the electrochemical cell.

TABLE 3-1. MECHANICAL AND ELECTRICAL SPECIFICATIONS

	70X	80X	100X
Net Weight	40 lbs (18.14 kg)	40 lbs (18.14 kg)	80 lbs (36.29 kg)
Shipping Weight	50 lbs (22.6 kg)	50 lbs (22.6 kg)	117 lbs (45.36 kg)
Dimensions			
Height	8.72 inches (24.2 cm)	12.22 inches (31.1 cm)	24.0 inches (62.2 cm)
Width	19.0 inches (48.3 cm)	19.0 inches (48.3 cm)	19.0 inches (48.3 cm)
Depth (from mounting surface)	10.0 inches (25.3 cm)	10.0 inches (25.3 cm)	12.5 inches (31.8 cm)
Depth (total)	12.75 inches (32.3 cm)	12.75 inches (32.3 cm)	15.1 inches (38.4 cm)
Mounting (standard 19-in RETMA rack)	EIA Specifications	EIA Specifications	EIA Specifications
Power	117/230 Vac; 48 to 400 Hz; 300 Watts, Max.	117/230 Vac; 48 to 400 Hz; 300 Watts, Max.	115/230 Vac; 48 to 63 Hz (400 Hz model available without compliance arm retraction system.) 275 Watts, Max.
Fuse	3.0 amperes, 3AG, slow blow, 250 Vac	3.0 amperes, 3AG, slow blow, 250 Vac	6.25/3.0 ampere, 3AG slow blow 115/230 Vac
Tape (computer grade):			
Width	0.5 inch (1.27 cm)	0.5 inch (1.27 cm)	0.5 inch (1.27 cm)
Thickness	1.5 mil (0.04 mm)	1.5 mil (0.04 mm)	1.5 mil (0.04 mm)
Reel Diameter	7 in (17.8 cm)	8.5 in (21.6 cm)	10.5 in (26.67 cm)
Tape Tension	8 ounces (226.8 grams)	8 ounces (226.8 grams)	8 ounces (226.8 grams)

TABLE 3-1. MECHANICAL AND ELECTRICAL SPECIFICATIONS (Continued)

	70X	80X	100X
Recording Mode & Density			
Seven-Track: IBM-compatible NRZI	200/556/800 bpi	200/556/800 bpi	200/556/800 bpi
Nine-Track: IBM-compatible NRZI	800 bpi	800 bpi	800 bpi
Nine-Track: IBM-compatible PE	1600 bpi	1600 bpi	1600 bpi
Nine-Track: IBM-compatible NRZI/PE	800/1600 bpi	800/1600 bpi	800/1600 bpi
Tape Speed	25/18.75/12.5 ips	37.5/25/18.75/12.5 ips	45/37.5/25/18.75/12.5 ips
Speed Variation			
Instantaneous	±5% (max., byte to byte) ±1% (max.)	±5% (max., byte to byte) ±1% (max.)	±3% (max., byte to byte) ±1% (max.)
Long Term	80 ips	100 ips (nom.)	150 ips (nom.)
Rewind Speed	15.0 (±0.55) ms @ 25 ips	10.0 (±0.55) ms @ 37.5 ips	8.0 (±0.55) ms at 45 ips
Start/Stop Time (inversely proportional to tape speed)	0.19 (±0.02) inch. 0.48 (±0.05) cm	0.19 (±0.02) inch 0.48 (±0.05) cm	0.19 (±0.02) inch 0.48 (±0.05) cm
Start/Stop Distance			
Interchannel Displacement Error:			
800 bpi	150 microinches (0.004 mm) max.	150 microinches (0.004 mm) max.	150 microinches (0.004 mm) max.
556 bpi	200 microinches (0.005 mm) max.	200 microinches (0.005 mm) max.	200 microinches (0.005 mm) max.

TABLE 3-1. MECHANICAL AND ELECTRICAL SPECIFICATIONS (Continued)

	70X	80X	100X
Beginning of Tape (BOT) and End of Tape (EOT) detectors	Photoelectric (IBM-compatible)	Photoelectric (IBM-compatible)	Photoelectric (IBM-compatible)
Interface	DTL (Low True)	DTL (Low True)	DTL (Low True)
Electronics	All silicon	All silicon	All silicon
Operating Temperature	2° to 50°C	2° to 50°C	2° to 50°C
Relative Humidity	15 to 95%, noncondensing	15 to 95%, noncondensing	15 to 95%, noncondensing
Altitude	20,000 feet (6096 meters) max.	20,000 feet (6096 meters) max.	20,000 feet (6096 meters) max.

- c. A 22 or 24-gauge conductor with minimum insulation thickness of 0.01 inch.

It is important that the ground side of each twisted pair be grounded within a few inches of the driver to which it is connected. The mating connectors (ELCO part number 00-6007-036-980-002 or equivalent) must be wired by the customer. As shown in Figure 3-2, interface signals are routed directly to and from the printed circuit boards. Strain relief should be provided. Table 3-2 shows the input/output lines required.

3.2 MULTIPLE-TRANSPORT (DAISY-CHAIN) SYSTEM MODIFICATION

Some system configurations require multiple tape transports; this can be accomplished by daisy-chaining the transports serially and then giving a specified address (ISLTØ - ISLT3) to each transport. The magnetic tape controller then can address one of four tape transports at any time. Each tape transport contains termination (220/330 ohm) resistor DIP packs in IC sockets. In a multiple transport system, it is necessary to remove the resistor packs from their sockets on all but the last transport.

The Cipher daisy chain cables have the following features:

- a. made from flat ribbon cable.
- b. compatible with the existing edge connectors.
- c. standard length of 6 feet tape transport to tape transport.
- d. controller to tape transport cable is 10 feet long.

The daisy-chain kit, if you were going to daisy-chain two tape drives and operate them through a Cipher formatter, will contain an MTU cable which is the cable that comes from the formatter to the first tape drive. These are three flat ribbon cables bundled together. At the formatter end you will have a printed wiring board with the standard 100-pin edge connector (Cipher Part No. 154030-102). At the tape drive end there will be two smaller printed circuit boards with edge connectors and one slightly larger PWB (Cipher Part No. 154030-001). The largest of the three contain a rotary select switch, an IC socket and molex connector. This PWB will be plugged into J101. The purpose of the IC socket is to contain the termination resistor pack, if this was the only tape drive on the chain. If it is the first tape drive of two or more, of course you would leave the resistor pack out of all IC sockets except the last drive.

THE UNIVERSITY OF CHICAGO
DIVISION OF THE PHYSICAL SCIENCES

REPORT OF THE
COMMISSIONER OF THE
BUREAU OF MINES
ON THE
PROGRESS OF THE
WORK DURING THE
YEAR 1900

BY
JOHN W. COOPER,
DIRECTOR
OF THE
BUREAU OF MINES
AND
GEORGE F. COOK,
CHIEF OF THE
DIVISION OF THE
PHYSICAL SCIENCES

CHICAGO
PUBLISHED BY THE
UNIVERSITY OF CHICAGO PRESS
1901

THE UNIVERSITY OF CHICAGO PRESS
1215 EAST 59TH STREET
CHICAGO, ILL.

PRINTED BY THE
UNIVERSITY OF CHICAGO PRESS
1215 EAST 59TH STREET
CHICAGO, ILL.

THE UNIVERSITY OF CHICAGO PRESS
1215 EAST 59TH STREET
CHICAGO, ILL.

The molex connector is for those machines that can accommodate a unit select switch. The unit select switch being an option, would then plug into the PWB which connects to J101. If you do not have a unit select switch, the printed wiring board contains a small rotary switch. This switch allows you to physically make the first drive unit 0, 1, 2, or 3. The other two printed wiring boards, one of which also contains an IC socket for the write terminators are for the read and write connections. The read printed wiring board and its connector contains no IC socket.

If you are looking at the second tape drive in the daisy-chain, then the other three cables that you receive, on one end would contain a small 3M connector which you plug into the previous adaptor boards that were plugged into tape drive number one. The opposite end would contain edge connectors and three of the printed wiring boards that we have discussed above.

Cipher's scheme of daisy-chain is very realistic, practical method of accommodating the differences in the control cables between a unit that has unit select and one that does not have unit select. Most competitive companies have to offer more than one type of daisy-chain cable for the control side due to the unit select and no unit select features. However, at Cipher we are able to do that with one daisy-chain cable.



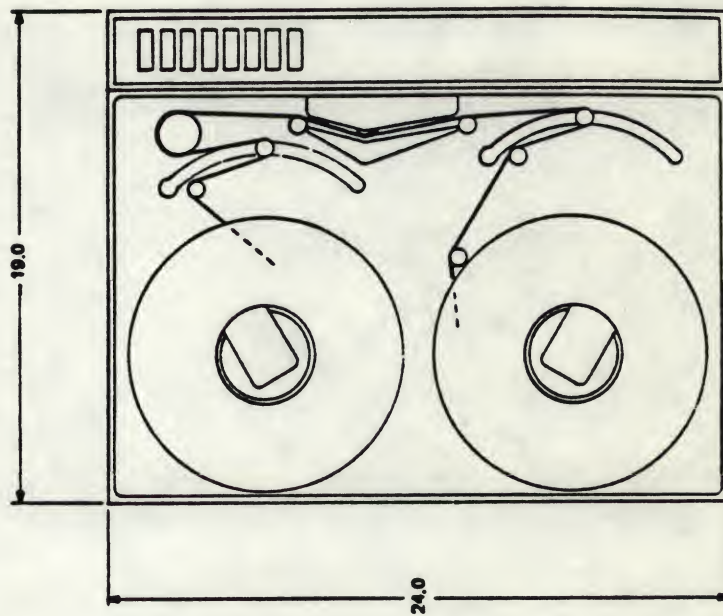
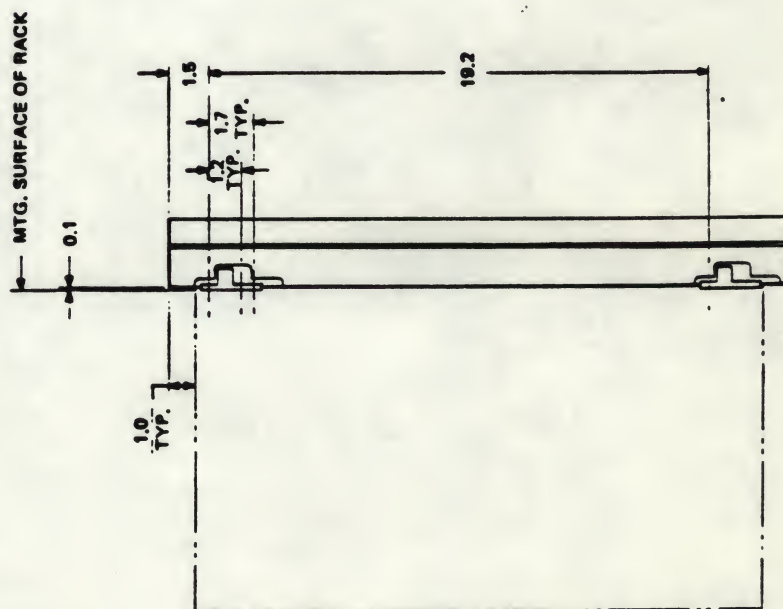
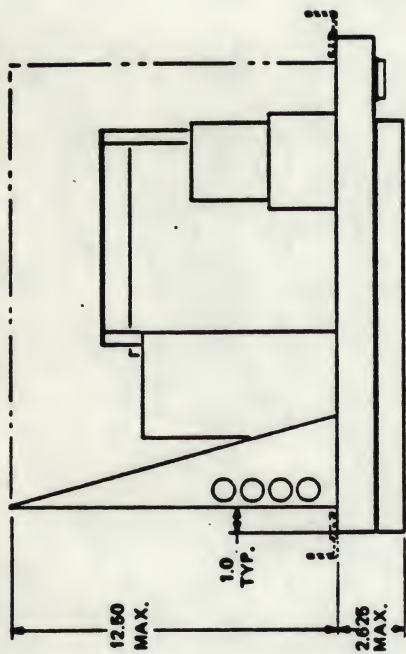
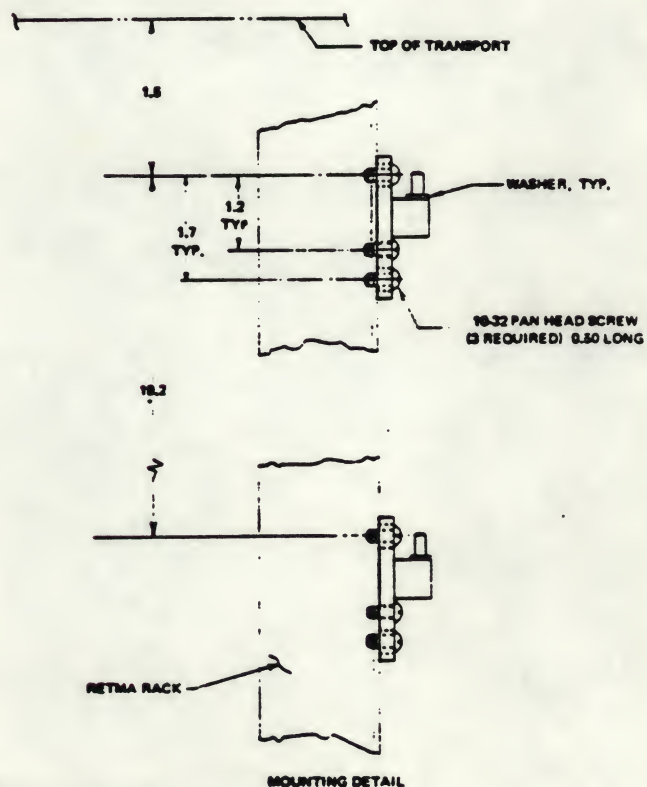
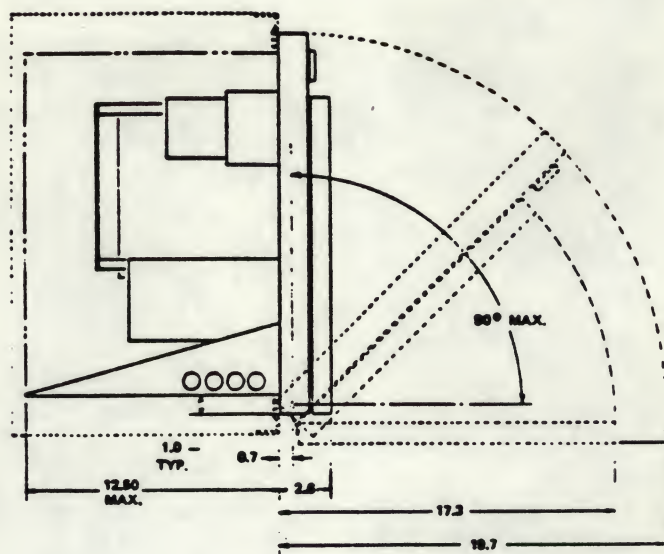


FIGURE 3-4 OUTLINE DIMENSIONS, MODEL 100X



DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED

FIGURE 3-5 RACK MOUNTING AND DIMENSIONS (100X)

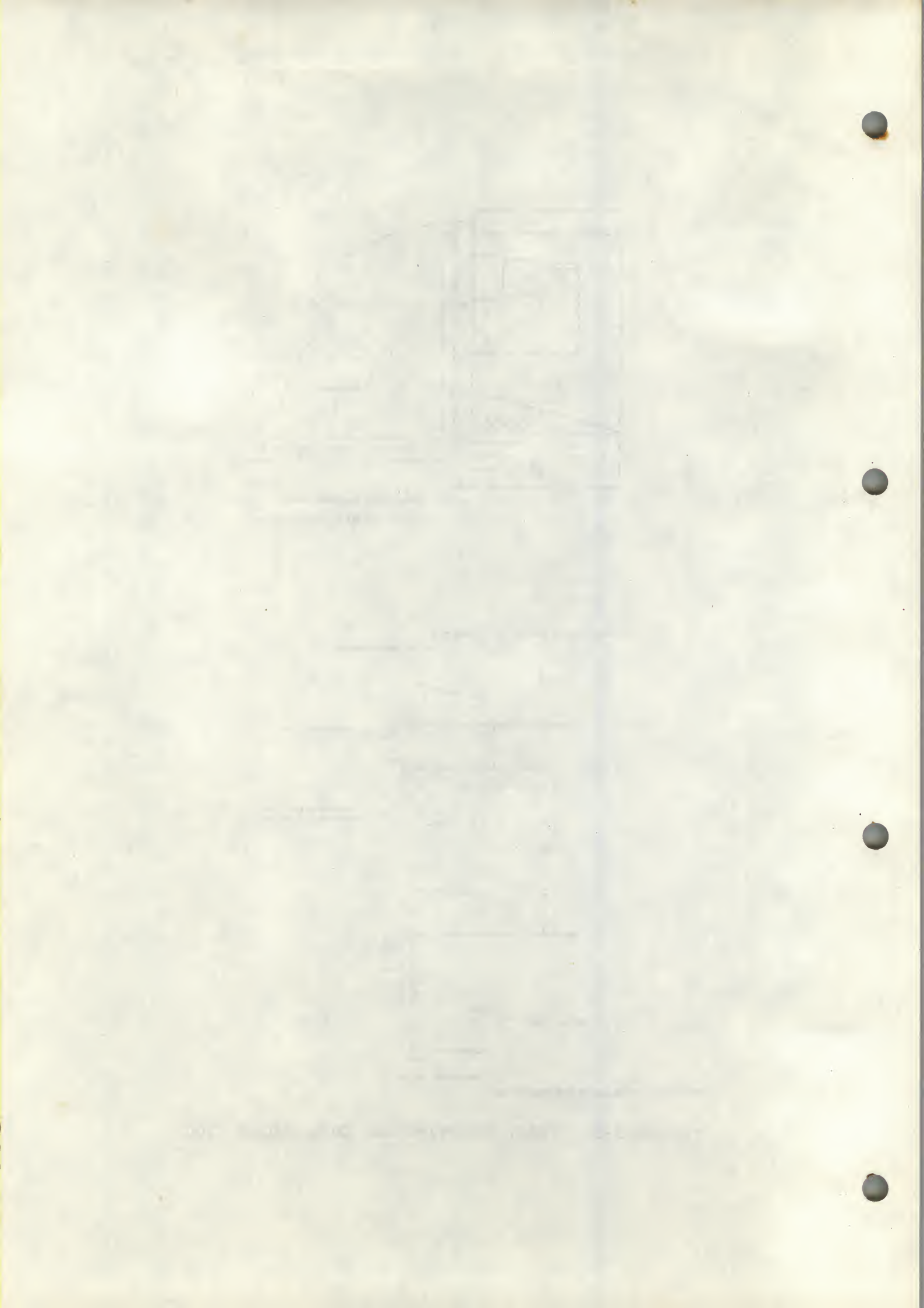


TABLE 3-2. INTERFACE CONNECTIONS

J101 ON TAPE CONTROL PCBA			
SIGNAL	LIVE PIN	GRN PIN	INPUT/OUTPUT
Select 1 (SILT1)	A	8	I
Overwrite (IOVW)	B	2	I
Forward (IFWD)	C	3	I
Data Density Select (IDDS)	D	4	I
Reverse (IREV)	E	5	I
Data Density Indicator (IDDI)	F	6	O
Rewind (IRWC)	H	7	I
Select 0 (ISLT0)	J	8	I
Write Enable (IWEN)	K	9	I
Off-Line (IOFL)	L	10	I
On-Line (IONL)	M	11	O
Rewind (IRWD)	N	12	O
File Protect (IFPT)	P	13	O
Load Point (ILD P)	R	14	O
+5V	S	N/C	O
Ready (IRDY)	T	16	O
End-of-Tape (IEOT)	U	17	O
Select 3 (ISLT3)	V	8	I
Select 2 (ISLT2)	18	8	I
Write Reset (IWRS) Tension Arm only part of IOVW option	15	N/C	I
J102 ON WRITE PCBA			
Write Data Strobe (IWDS)	A	1	I
	B	2	N/C
Write Amplifier Reset (IWARS)	C	3	I
	D	4	N/C
Read Threshold 1 (IRTH1) Omit on new dual mode p/n 154040-0XX	E	5	I
Read Threshold 2 (IRTH2)	F	6	I
	H	7	N/C

MEMORANDUM FOR THE RECORD

DATE: 10/10/54
 TO: THE CHIEF OF BUREAU
 FROM: [illegible]
 SUBJECT: [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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100	100	100	100	100

[illegible text block]

TABLE 3-2. INTERFACE CONNECTIONS (Continued)

SIGNAL	LIVE PIN	GRN PIN	INPUT/ OUTPUT
Select Line (Optional)	J	8	I
Select Line (Optional)	K	9	I
Write Data P (IWDP)	L	10	I
Write Data Ø (IWDØ) Omit for 7-track	M	11	I
Write Data 1 (IWD1) Omit for 7-track	N	12	I
Write Data 2 (IWD2)	P	13	I
Write Data 3 (IWD3)	R	14	I
Write Data 4 (IWD4)	S	15	I
Write Data 5 (IWD5)	T	16	I
Write Data 6 (IWD6)	U	17	I
Write Data 7 (IWD7)	V	18	I
J103 ON READ PCBA			
Read Data Parity (IRDp)	1	A	O
Read Data Strobe (IRDS)	2	B	O
Read Data Ø (IRDØ)	3	C	O
Read Data 1 (IRD1)	4	D	O
Select Line (Optional)	5	E	I
Select Line (Optional)	6	F	I
	7	H	N/C
Read Data 2 (IRD2)	8	J	O
Read Data 3 (IRD3)	9	K	O
Non-Return-to-Zero (INRZ) optional on new dual mode p/n 154050-0xx	10	L	O
Seven Track (I7TR) omit on dual mode p/n 154050-0xx	11	M	O

Summary of the 1950-1951 Season

Year	Area	Population	Notes
1950	1	100	Initial survey
1951	2	150	Increased area
1952	3	200	Further expansion
1953	4	250	Stable growth
1954	5	300	Continued progress
1955	6	350	Significant increase
1956	7	400	Peak population
1957	8	450	Stabilization
1958	9	500	Final count

Year	Area	Population	Notes
1959	10	550	Continued growth
1960	11	600	Stable population
1961	12	650	Increased area
1962	13	700	Further expansion
1963	14	750	Stable growth
1964	15	800	Continued progress
1965	16	850	Significant increase
1966	17	900	Peak population
1967	18	950	Stabilization
1968	19	1000	Final count

TABLE 3-2. INTERFACE CONNECTIONS (Continued)

SIGNAL	LIVE PIN	GRN PIN	INPUT/ OUTPUT
Single Gap (ISGL) omit on dual mode	12	N	O
Speed (ISP) omit on dual mode	13	P	O
Read Data 4 (IRD4)	14	R	O
Read Data 5 (IRD5)	15	S	O
	16	T	N/C
Read Data 6 (IRD6)	17	U	O
Read Data 7 (IRD7)	18	V	O

THE UNIVERSITY OF CHICAGO

NAME	RESIDENCE	DATE	REMARKS
J. H.
...
...
...
...

TABLE 3-3. INTERFACE INPUTS

INPUT	TYPE	FUNCTION
Select (SLT)	Level	When true, enables all interface drivers and receivers in transport, thus connecting transport to controller.
Forward (FWD)	Level	When true, with transport ready and on line, causes tape to move forward at specified speed.
Reverse (REV)	Level	When true, with transport ready and on line, causes tape to move in reverse at specified speed.
Rewind (RWC)	Pulse	With transport ready and on line, this pulse causes tape to move in reverse at 150 ips to BOT.
Off-Line (OFL)	Level or pulse (min. width, 2 microseconds)	Resets on-line flip-flop to 0 state, placing transport under manual control.
Write Data Strobe (WDS)	Pulse (min., 2 microseconds)	Trailing edge triggers code generator in transport.
Write Data (WD)	9 lines for 9-track; 7 lines for 7-track	When true from 0.5 microsecond before leading edge to 0.5 microsecond after trailing edge of write strobe, results in recording of flux transition when in write mode.
Write Enable (WEN)	Level	When true for 20 microseconds, minimum, after leading edge of FORWARD or REVERSE command, initiates write mode of operation.
Reset (RS)	Pulse (min., 2 microseconds)	When true, resets write amplifier circuits on leading edge. Purpose is to write LRCC at end of record, causing all channels to be erased in IRG.
Data Density Select (DDS)	Level	When true, conditions read electronics to operate in high-density mode. When false, operation is in low-density mode.

TABLE 3-3. INTERFACE INPUTS (Continued)

INPUT	TYPE	FUNCTION
Overwrite (OVW)	Level	When true, conditions appropriate circuitry, in conjunction with Write Reset (WRS) pulse, for updating (rewriting) of select record. Transport must be in write mode.

TABLE 3-4. INTERFACE OUTPUTS

INPUT	TYPE	FUNCTION
On-Line	Level	When true (on-line flip-flop set), transport is under remote control. When false, transport is under local control.
Read Data (RD) (RDP, RD0-7 for 9-channel; RDC, RD2-7 for 7-channel)	Bits	Sampling of RDP, RD0-7 simultaneously on trailing edge of Read Data Strobe (RDS) provides complete data character.
Read Data Strobe (RDS)	Pulse (min., 2 ms)	Provides complete data character when RDP, RD0-7 sampled on trailing edge.
End of Tape (EOT)	Level	True for duration of EOT tab. Transitions to and from true state not to be assumed clean.
Density (DEN)	Level	True only when manual HI DEN switch on transport is set for high density.
Ready (RDY)	Level	True when load sequence is complete and transport is on line and not rewinding. (Transport ready to receive remote command.)
Beginning of Tape (BOT)	Level	True when BOT tab is under photo-sensor, initial load sequence is complete, and transport is not rewinding.
Rewind (RWD)	Level	True only when transport is engaged in rewind operation or load sequence following rewind.

MEMORANDUM FOR THE RECORD

DATE: 10/10/54

TO: Mr. Tolson

FROM: Mr. [illegible]

SUBJECT: [illegible]

1. [illegible]

2. [illegible]

3. [illegible]

4. [illegible]

5. [illegible]

6. [illegible]

7. [illegible]

8. [illegible]

9. [illegible]

TABLE 3-4. INTERFACE OUTPUTS (Continued)

INPUT	TYPE	FUNCTION
File Protect (FPT)	Level	True when power is on and reel of tape without write ring is mounted on transport.
NRZI Transport Identification (NRZ)	Level (Optional)	True when transport is configured for NRZI data. False level indicates phase-encode configuration.
7-Track Head Identification (7TK)	Level (Optional)	True for 7-track transport; false for 9-track configuration.
Single-Gap Head Identification (SGL)	Level (Optional)	True when transport has single-gap head; false level indicates dual-gap head.
Transport Speed Identification (SPD)	Level (Optional)	True when transport has lower of two speeds available in multiple-transport system.

Date		Particulars	Debit	Credit
1900	Jan 1	Balance		100.00
	Jan 2	By Cash	50.00	
	Jan 3	To Cash		25.00
	Jan 4	By Cash	75.00	
	Jan 5	To Cash		100.00
	Jan 6	By Cash	125.00	
	Jan 7	To Cash		150.00
	Jan 8	By Cash	175.00	
	Jan 9	To Cash		200.00
	Jan 10	By Cash	225.00	
	Jan 11	To Cash		250.00
	Jan 12	By Cash	275.00	
	Jan 13	To Cash		300.00
	Jan 14	By Cash	325.00	
	Jan 15	To Cash		350.00
	Jan 16	By Cash	375.00	
	Jan 17	To Cash		400.00
	Jan 18	By Cash	425.00	
	Jan 19	To Cash		450.00
	Jan 20	By Cash	475.00	
	Jan 21	To Cash		500.00
	Jan 22	By Cash	525.00	
	Jan 23	To Cash		550.00
	Jan 24	By Cash	575.00	
	Jan 25	To Cash		600.00
	Jan 26	By Cash	625.00	
	Jan 27	To Cash		650.00
	Jan 28	By Cash	675.00	
	Jan 29	To Cash		700.00
	Jan 30	By Cash	725.00	
	Jan 31	To Cash		750.00
	Feb 1	By Cash	775.00	
	Feb 2	To Cash		800.00
	Feb 3	By Cash	825.00	
	Feb 4	To Cash		850.00
	Feb 5	By Cash	875.00	
	Feb 6	To Cash		900.00
	Feb 7	By Cash	925.00	
	Feb 8	To Cash		950.00
	Feb 9	By Cash	975.00	
	Feb 10	To Cash		1000.00
	Feb 11	By Cash	1025.00	
	Feb 12	To Cash		1050.00
	Feb 13	By Cash	1075.00	
	Feb 14	To Cash		1100.00
	Feb 15	By Cash	1125.00	
	Feb 16	To Cash		1150.00
	Feb 17	By Cash	1175.00	
	Feb 18	To Cash		1200.00
	Feb 19	By Cash	1225.00	
	Feb 20	To Cash		1250.00
	Feb 21	By Cash	1275.00	
	Feb 22	To Cash		1300.00
	Feb 23	By Cash	1325.00	
	Feb 24	To Cash		1350.00
	Feb 25	By Cash	1375.00	
	Feb 26	To Cash		1400.00
	Feb 27	By Cash	1425.00	
	Feb 28	To Cash		1450.00
	Feb 29	By Cash	1475.00	
	Feb 30	To Cash		1500.00
	Mar 1	By Cash	1525.00	
	Mar 2	To Cash		1550.00
	Mar 3	By Cash	1575.00	
	Mar 4	To Cash		1600.00
	Mar 5	By Cash	1625.00	
	Mar 6	To Cash		1650.00
	Mar 7	By Cash	1675.00	
	Mar 8	To Cash		1700.00
	Mar 9	By Cash	1725.00	
	Mar 10	To Cash		1750.00
	Mar 11	By Cash	1775.00	
	Mar 12	To Cash		1800.00
	Mar 13	By Cash	1825.00	
	Mar 14	To Cash		1850.00
	Mar 15	By Cash	1875.00	
	Mar 16	To Cash		1900.00
	Mar 17	By Cash	1925.00	
	Mar 18	To Cash		1950.00
	Mar 19	By Cash	1975.00	
	Mar 20	To Cash		2000.00
	Mar 21	By Cash	2025.00	
	Mar 22	To Cash		2050.00
	Mar 23	By Cash	2075.00	
	Mar 24	To Cash		2100.00
	Mar 25	By Cash	2125.00	
	Mar 26	To Cash		2150.00
	Mar 27	By Cash	2175.00	
	Mar 28	To Cash		2200.00
	Mar 29	By Cash	2225.00	
	Mar 30	To Cash		2250.00
	Mar 31	By Cash	2275.00	
	Apr 1	To Cash		2300.00
	Apr 2	By Cash	2325.00	
	Apr 3	To Cash		2350.00
	Apr 4	By Cash	2375.00	
	Apr 5	To Cash		2400.00
	Apr 6	By Cash	2425.00	
	Apr 7	To Cash		2450.00
	Apr 8	By Cash	2475.00	
	Apr 9	To Cash		2500.00
	Apr 10	By Cash	2525.00	
	Apr 11	To Cash		2550.00
	Apr 12	By Cash	2575.00	
	Apr 13	To Cash		2600.00
	Apr 14	By Cash	2625.00	
	Apr 15	To Cash		2650.00
	Apr 16	By Cash	2675.00	
	Apr 17	To Cash		2700.00
	Apr 18	By Cash	2725.00	
	Apr 19	To Cash		2750.00
	Apr 20	By Cash	2775.00	
	Apr 21	To Cash		2800.00
	Apr 22	By Cash	2825.00	
	Apr 23	To Cash		2850.00
	Apr 24	By Cash	2875.00	
	Apr 25	To Cash		2900.00
	Apr 26	By Cash	2925.00	
	Apr 27	To Cash		2950.00
	Apr 28	By Cash	2975.00	
	Apr 29	To Cash		3000.00
	Apr 30	By Cash	3025.00	
	May 1	To Cash		3050.00
	May 2	By Cash	3075.00	
	May 3	To Cash		3100.00
	May 4	By Cash	3125.00	
	May 5	To Cash		3150.00
	May 6	By Cash	3175.00	
	May 7	To Cash		3200.00
	May 8	By Cash	3225.00	
	May 9	To Cash		3250.00
	May 10	By Cash	3275.00	
	May 11	To Cash		3300.00
	May 12	By Cash	3325.00	
	May 13	To Cash		3350.00
	May 14	By Cash	3375.00	
	May 15	To Cash		3400.00
	May 16	By Cash	3425.00	
	May 17	To Cash		3450.00
	May 18	By Cash	3475.00	
	May 19	To Cash		3500.00
	May 20	By Cash	3525.00	
	May 21	To Cash		3550.00
	May 22	By Cash	3575.00	
	May 23	To Cash		3600.00
	May 24	By Cash	3625.00	
	May 25	To Cash		3650.00
	May 26	By Cash	3675.00	
	May 27	To Cash		3700.00
	May 28	By Cash	3725.00	
	May 29	To Cash		3750.00
	May 30	By Cash	3775.00	
	May 31	To Cash		3800.00
	Jun 1	By Cash	3825.00	
	Jun 2	To Cash		3850.00
	Jun 3	By Cash	3875.00	
	Jun 4	To Cash		3900.00
	Jun 5	By Cash	3925.00	
	Jun 6	To Cash		3950.00
	Jun 7	By Cash	3975.00	
	Jun 8	To Cash		4000.00
	Jun 9	By Cash	4025.00	
	Jun 10	To Cash		4050.00
	Jun 11	By Cash	4075.00	
	Jun 12	To Cash		4100.00
	Jun 13	By Cash	4125.00	
	Jun 14	To Cash		4150.00
	Jun 15	By Cash	4175.00	
	Jun 16	To Cash		4200.00
	Jun 17	By Cash	4225.00	
	Jun 18	To Cash		4250.00
	Jun 19	By Cash	4275.00	
	Jun 20	To Cash		4300.00
	Jun 21	By Cash	4325.00	
	Jun 22	To Cash		4350.00
	Jun 23	By Cash	4375.00	
	Jun 24	To Cash		4400.00
	Jun 25	By Cash	4425.00	
	Jun 26	To Cash		4450.00
	Jun 27	By Cash	4475.00	
	Jun 28	To Cash		4500.00
	Jun 29	By Cash	4525.00	
	Jun 30	To Cash		4550.00
	Jul 1	By Cash	4575.00	
	Jul 2	To Cash		4600.00
	Jul 3	By Cash	4625.00	
	Jul 4	To Cash		4650.00
	Jul 5	By Cash	4675.00	
	Jul 6	To Cash		4700.00
	Jul 7	By Cash	4725.00	
	Jul 8	To Cash		4750.00
	Jul 9	By Cash	4775.00	
	Jul 10	To Cash		4800.00
	Jul 11	By Cash	4825.00	
	Jul 12	To Cash		4850.00
	Jul 13	By Cash	4875.00	
	Jul 14	To Cash		4900.00
	Jul 15	By Cash	4925.00	
	Jul 16	To Cash		4950.00
	Jul 17	By Cash	4975.00	
	Jul 18	To Cash		5000.00
	Jul 19	By Cash	5025.00	
	Jul 20	To Cash		5050.00
	Jul 21	By Cash	5075.00	
	Jul 22	To Cash		5100.00
	Jul 23	By Cash	5125.00	
	Jul 24	To Cash		5150.00
	Jul 25	By Cash	5175.00	
	Jul 26	To Cash		5200.00
	Jul 27	By Cash	5225.00	
	Jul 28	To Cash		5250.00
	Jul 29	By Cash	5275.00	
	Jul 30	To Cash		5300.00
	Jul 31	By Cash	5325.00	
	Aug 1	To Cash		5350.00
	Aug 2	By Cash	5375.00	
	Aug 3	To Cash		5400.00
	Aug 4	By Cash	5425.00	
	Aug 5	To Cash		5450.00
	Aug 6	By Cash	5475.00	
	Aug 7	To Cash		5500.00
	Aug 8	By Cash	5525.00	
	Aug 9	To Cash		5550.00
	Aug 10	By Cash	5575.00	
	Aug 11	To Cash		5600.00
	Aug 12	By Cash	5625.00	
	Aug 13	To Cash		5650.00
	Aug 14	By Cash	5675.00	
	Aug 15	To Cash		5700.00
	Aug 16	By Cash	5725.00	
	Aug 17	To Cash		5750.00
	Aug 18	By Cash	5775.00	
	Aug 19	To Cash		5800.00
	Aug 20	By Cash	5825.00	
	Aug 21	To Cash		5850.00
	Aug 22	By Cash	5875.00	
	Aug 23	To Cash		5900.00
	Aug 24	By Cash	5925.00	
	Aug 25	To Cash		5950.00
	Aug 26	By Cash	5975.00	
	Aug 27	To Cash		6000.00
	Aug 28	By Cash	6025.00	
	Aug 29	To Cash		6050.00
	Aug 30	By Cash	6075.00	
	Aug 31	To Cash		6100.00
	Sep 1	By Cash	6125.00	
	Sep 2	To Cash		6150.00
	Sep 3	By Cash	6175.00	
	Sep 4	To Cash		6200.00
	Sep 5	By Cash	6225.00	
	Sep 6	To Cash		6250.00
	Sep 7	By Cash	6275.00	
	Sep 8	To Cash		6300.00
	Sep 9	By Cash	6325.00	
	Sep 10	To Cash		6350.00
	Sep 11	By Cash	6375.00	
	Sep 12	To Cash		6400.00
	Sep 13	By Cash	6425.00	
	Sep 14	To Cash		6450.00
	Sep 15	By Cash	6475.00	
	Sep 16	To Cash		6500.00
	Sep 17	By Cash	6525.00	
	Sep 18	To Cash		6550.00
	Sep 19	By Cash	6575.00	
	Sep 20	To Cash		6600.00
	Sep 21	By Cash	6625.00	
	Sep 22	To Cash		6650.00
	Sep 23	By Cash	6675.00	
	Sep 24	To Cash		6700.00
	Sep 25	By Cash	6725.00	
	Sep 26	To Cash		6750.00
	Sep 27	By Cash	6775.00	
	Sep 28	To Cash		6800.00
	Sep 29	By Cash	6825.00	
	Sep 30	To Cash		6850.00
	Oct 1	By Cash	6875.00	
	Oct 2	To Cash		6900.00
	Oct 3	By Cash	6925.00	
	Oct 4	To Cash		6950.00
	Oct 5	By Cash	6975.00	
	Oct 6	To Cash		7000.00
	Oct 7	By Cash	7025.00	
	Oct 8	To Cash		7050.00
	Oct 9	By Cash	7075.00	
	Oct 10	To Cash		7100.00
	Oct 11	By Cash	7125.00	
	Oct 12	To Cash		7150.00
	Oct 13	By Cash	7175.00	
	Oct 14	To Cash		7200.00
	Oct 15	By Cash	7225.00	
	Oct 16	To Cash		7250.00
	Oct 17	By Cash	7275.00	
	Oct 18	To Cash		7300.00
	Oct 19	By Cash	7325.00	
	Oct 20	To Cash		7350.00
	Oct 21	By Cash	7375.00	
	Oct 22	To Cash		7400.00
	Oct 23	By Cash	7425.00	
	Oct 24	To Cash		7450.00
	Oct 25	By Cash		

TABLE 3-5. CONTROL LOGIC OPTIONS

FUNCTION	PURPOSE
STATUS INDICATIONS	When installed, provides status indications to interface when transport is on line and selected. When not installed, status indications are provided whenever transport is selected.
LOCAL/REMOTE DENSITY SELECT	Provides local density control, with indicator, on seven-track models. Provides remote density control, with indicator, on seven-track models. Installed with fixed-density models, Indicator always illuminated.
OVERWRITE	Installed with overwrite option. Note write reset jumper on read/write board.
REWIND/READY	READY signal resets REWIND status. REWIND status resets before READY.
ON LINE/READY	When installed, depression of ON LINE pushbutton will force ready status in middle of tape.
REWIND/OFF LINE	When installed, will cause unit to revert to off-line status when rewind is commanded remotely.
+5V SUPPLY	Diode can be installed (cathode to N, anode to P) to provide +5 volts for customer's terminators.
WRITE ENABLE	Normal configuration: Write Enable line is sampled and stored 20 microseconds after RUN command is given. Output of stored signal becomes Read/Write signal to read/write board. Read/Write signal is controlled directly from Write Enable line.
AUTOMATIC POWER RESTORE	Transport retensions tape and goes on line when power restored after outage.

REPORT OF THE

NAME	ADDRESS
J. H. BROWN, JR.	1234 MAIN ST., NEW YORK, N. Y.
W. H. GREEN, JR.	5678 AVE., CHICAGO, ILL.
C. H. WHITE, JR.	9012 ST., PHOENIX, ARIZ.
T. H. BLACK, JR.	3456 BLVD., LOS ANGELES, CALIF.
L. H. GRAY, JR.	7890 HWY., SAN FRANCISCO, CALIF.
R. H. HARRIS, JR.	2345 CIRCLE, SEATTLE, WASH.
D. H. KING, JR.	6789 PARK, PORTLAND, ORE.
S. H. LEE, JR.	10111 RAMP, OAKLAND, CALIF.
M. H. NELSON, JR.	4567 DRIVE, SAN JOSE, CALIF.

TABLE 3-6. DATA LOGIC OPTIONS

FUNCTION	PURPOSE
WRITE DATA TIMING	Write data on trailing edge of WDS. Write data on leading edge of WDS.
WRITE RESET	Standard WRS path. Used with overwrite option on read/write models. Only one RESET command required for either overwrite or normal mode.
THRESHOLD COMMAND PATH	Standard path for THRESHOLD command in read/write models. Standard path for automatic THRESHOLD command in read-after-write models.

BASIC CONCEPTS OF DIGITAL RECORDING

The concept of digital magnetic tape recording has grown in acceptance as a result of the increased use of digital techniques, the increasing variety of recorders available, and the decreased cost of these recorders. The digital recording process involves methods and equipment capable of recording information expressed in a digital (binary) code (1's and 0's). The IBM NRZI system (non-return-to-zero interrupt) is the one most widely used throughout the industry.

Figure 4-1 depicts various codings, including the NRZI code. On magnetic tape, binary 1's are represented by transitions between plus and minus saturation magnetism (+SAT and -SAT) produced by the corresponding write head current. When a written tape is passed across the tape head, a change of flux occurs at the gap. The magnetic heads respond, producing the read voltage waveforms illustrated in Figure 4-1. Absence of a change in flux represents a binary 0, for which no voltage is recovered from the head.

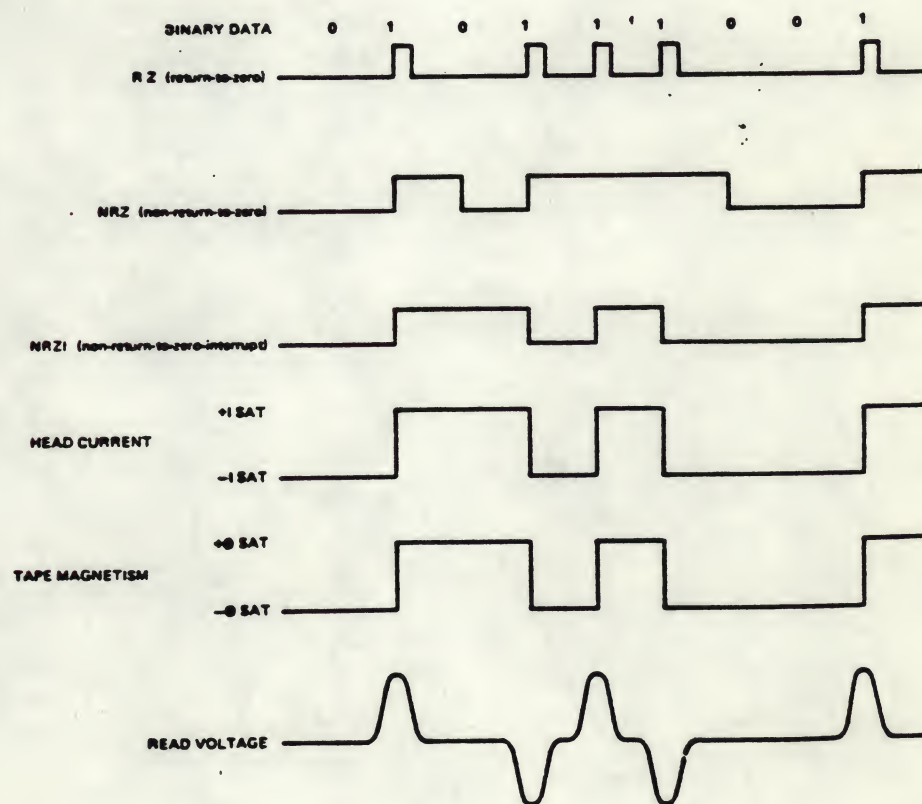


FIGURE 4-1 MAGNETIC RECORDING WAVEFORMS

Handwritten Title

Handwritten paragraph of text, likely an introduction or first section of the document.

Handwritten paragraph of text, likely a second section or continuation of the first.

Handwritten line of text, possibly a sub-header or section separator.

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NRZI SYSTEM

NINE-TRACK CODING.

Any 8-bit code, such as ASCII or EBCDIC, may be used. (See Figure 4-2.)

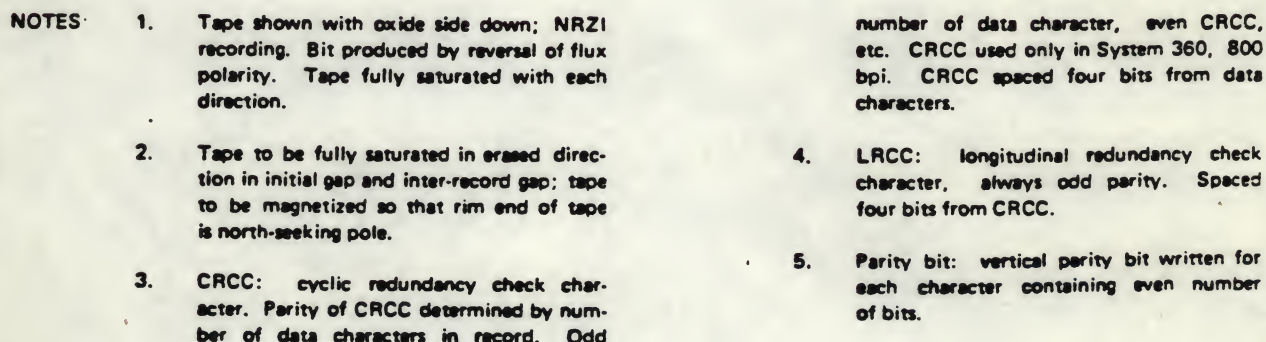


FIGURE 4-2 NRZI NINE-TRACK DATA FORMAT

Page 128

The first part of the report deals with the general situation of the country. It is a very interesting and informative account of the country and its people. The author has done a great deal of research and has written a very thorough and accurate report.

The second part of the report deals with the specific details of the country. It is a very detailed and accurate account of the country and its people. The author has done a great deal of research and has written a very thorough and accurate report.

The third part of the report deals with the specific details of the country. It is a very detailed and accurate account of the country and its people. The author has done a great deal of research and has written a very thorough and accurate report.

The fourth part of the report deals with the specific details of the country. It is a very detailed and accurate account of the country and its people. The author has done a great deal of research and has written a very thorough and accurate report.

The fifth part of the report deals with the specific details of the country. It is a very detailed and accurate account of the country and its people. The author has done a great deal of research and has written a very thorough and accurate report.

The sixth part of the report deals with the specific details of the country. It is a very detailed and accurate account of the country and its people. The author has done a great deal of research and has written a very thorough and accurate report.

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The eighth part of the report deals with the specific details of the country. It is a very detailed and accurate account of the country and its people. The author has done a great deal of research and has written a very thorough and accurate report.

The ninth part of the report deals with the specific details of the country. It is a very detailed and accurate account of the country and its people. The author has done a great deal of research and has written a very thorough and accurate report.

The tenth part of the report deals with the specific details of the country. It is a very detailed and accurate account of the country and its people. The author has done a great deal of research and has written a very thorough and accurate report.

The eleventh part of the report deals with the specific details of the country. It is a very detailed and accurate account of the country and its people. The author has done a great deal of research and has written a very thorough and accurate report.

The twelfth part of the report deals with the specific details of the country. It is a very detailed and accurate account of the country and its people. The author has done a great deal of research and has written a very thorough and accurate report.

LONGITUDINAL REDUNDANCY CHECK CHARACTER (LRCC).

A longitudinal parity bit is written at the end of each record. This character is written by the return of the write head current to the reference condition.

Since the reference condition is established before the first character of the record and reestablished by writing of the LRCC, an even number of 1 bits in each track is written for each record. As the tape is read, the number of 1's read in each track is counted. If the sum is odd, an error is indicated. The LRCC is spaced four character spaces from the end of the block.

CYCLIC REDUNDANCY CHECK CHARACTER (CRCC).

Nine-track, 800-bpi tapes include a CRCC located at the end of each record before the LRCC. The CRCC is generated by application of a complex equation of the data within the block.

This character makes the probability of an undetected error almost zero. The CRCC may be used with the computer read function to determine which track contains the error. The information supplied by the CRCC, combined with that of the LRCC and vertical parity, may be used to correct detected errors. Errors involving more than one track within the same record are not correctable.

4.2

PHASE-ENCODE SYSTEM

The differences between phase-encoded (PE) and NRZI writing are chiefly in presentation and phasing or coding. In NRZI coding, a single change of polarization on the tape represents a logical 1, while no change represents a logical 0. In PE writing, both the logical 1 and 0 involve changes in polarization. Phasing, however, is the key difference between PE and NRZI. The major advantages offered by PE are reduced possibility of losing data because of inadequate signal strength (making practical low read thresholds) and the fact that each track is self-clocking, reducing skew problems. PE writing is done only in a nine-track mode. Basic features of the PE system are as follows (Figure 4-3):

- a. A change in tape polarity at the interface from negative to positive is a 1 bit.
- b. A change from positive to negative is a 0 bit.

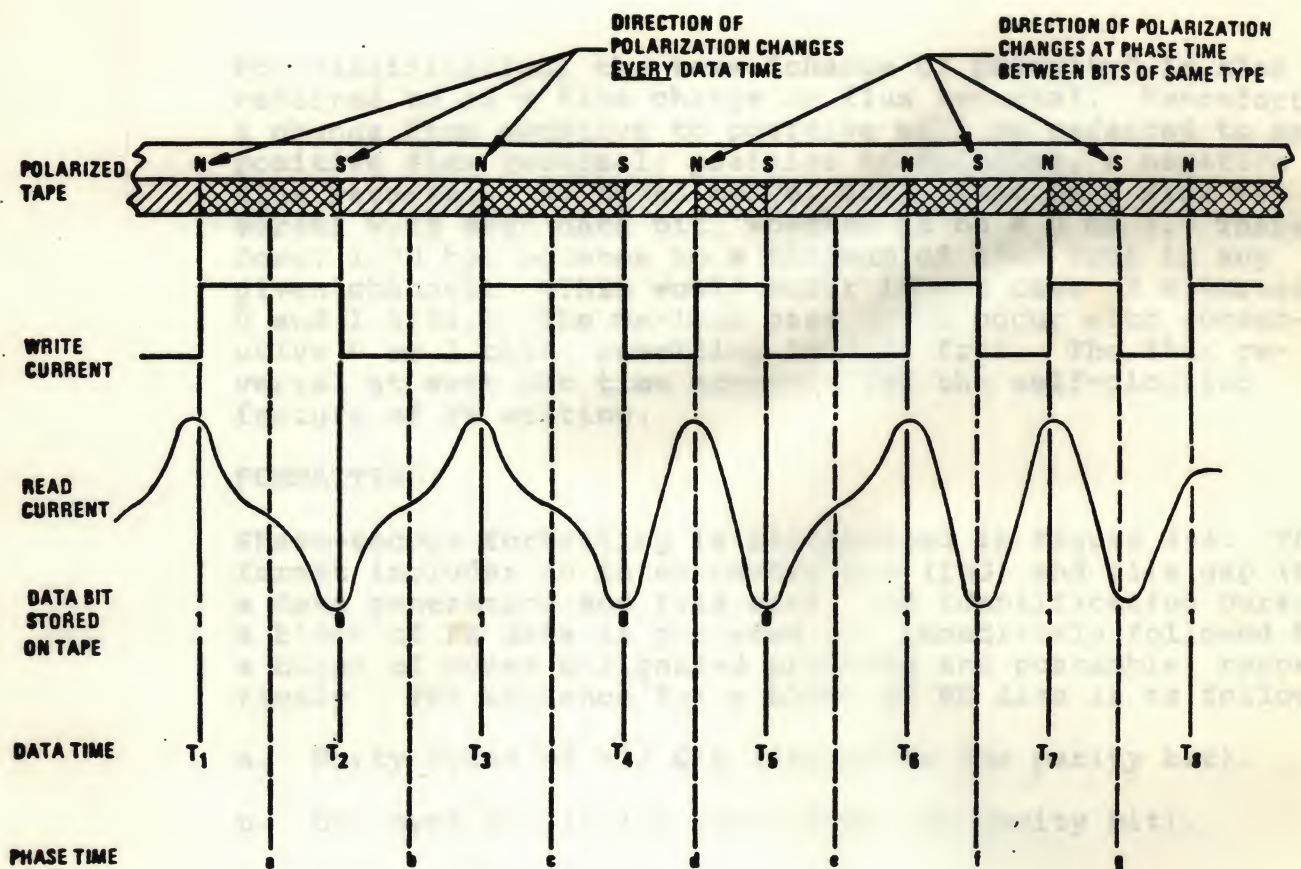


FIGURE 4-3 PHASE-ENCODED TAPE MAGNETIZATION

- c. There must be a change of polarity between data bits of the same polarity (consecutive 1 or 0 bits) at phase time.
 - (1) Two consecutive 1 bits must be separated by a change at phase time from positive to negative polarity.
 - (2) Two consecutive 0 bits must be separated by a change at phase time from negative to positive polarity.
- d. There must be a change of polarity at each data bit time.
- e. There must not be a change of polarity at the phase time between alternate data states.
- f. The PE transport records and reads data at a density of 1600 bits per inch (bpi) of tape travel.



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